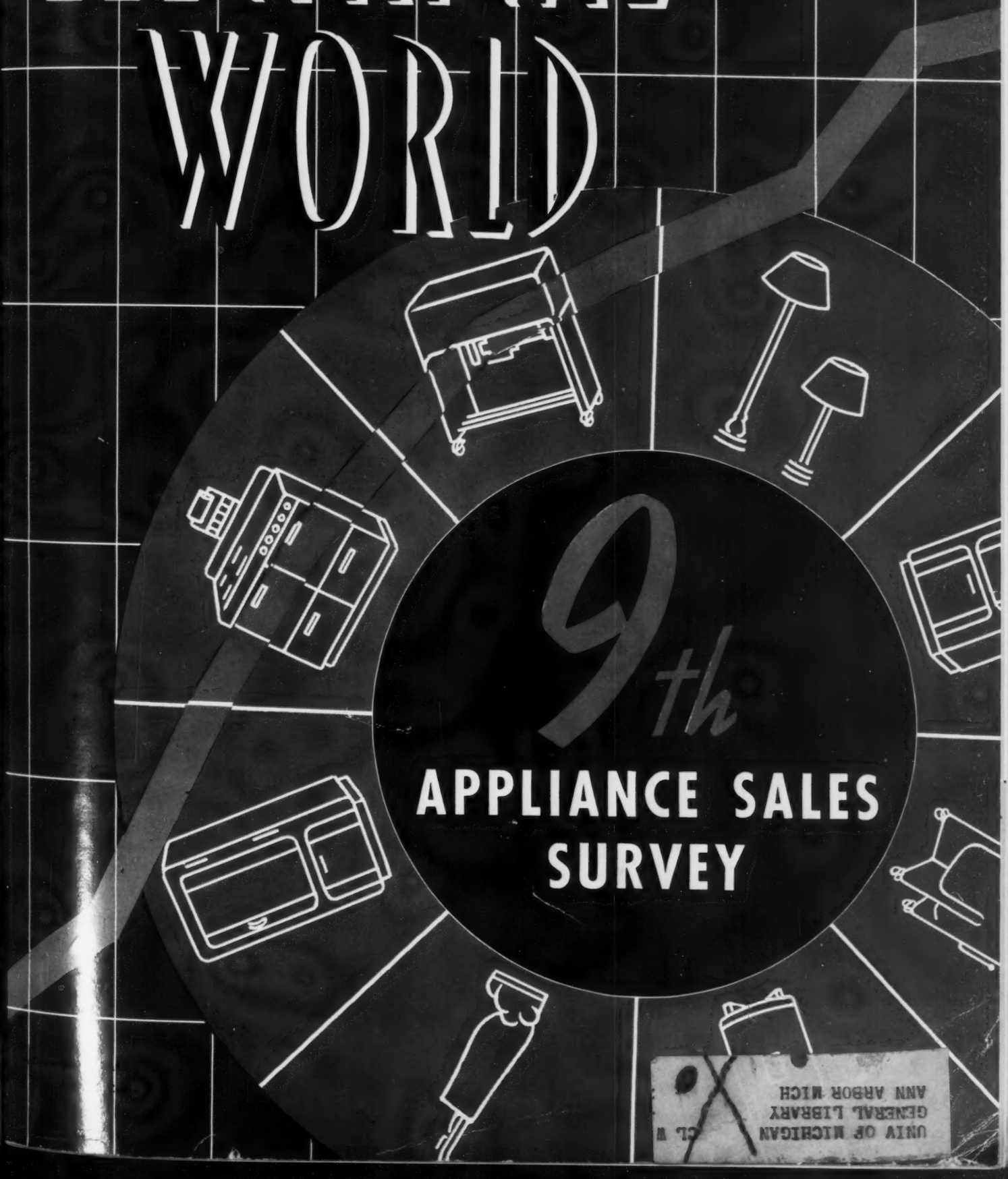
ELECTRICAL WORLD



9th

APPLIANCE SALES SURVEY

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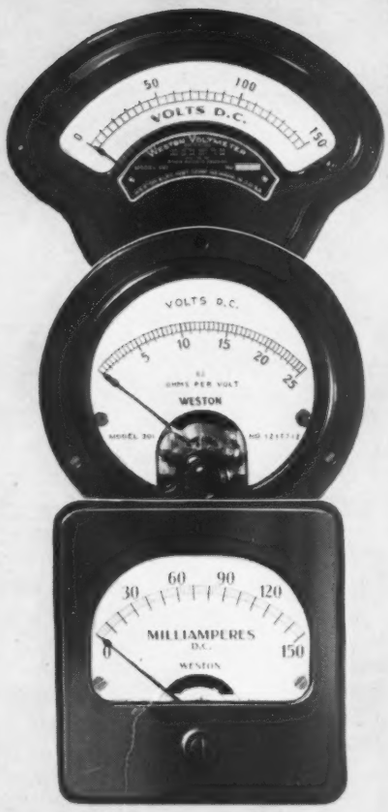
WHEN BUYERS MAKE EXACTING

point by point

COMPARISONS



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Letters TO THE EDITOR

Comment on Power Factor Formula

To the Editor of ELECTRICAL WORLD:

No doubt by this time you have received several letters regarding the item "A Power Factor Formula," contributed by C. O. Van Dennenberg, appearing on page 23 of the December 17, 1938, issue of ELECTRICAL WORLD. Obviously, either typographical errors are responsible for the formula given or Mr. Van Dannenberg has erred in his trigonometrical transformations.

Starting with the usual formula

$$\tan\theta = \sqrt{3}\left(\frac{W_2 - W_1}{W_2 + W_1}\right)$$

where W_2 and W_1 are the two watt-meter readings and W_1 less than W_2 and using the identity $\text{Sec}^2\theta = 1 - \tan^2\theta$ we arrive at the formula

$$\text{Cos}\,\theta = \frac{1}{\sqrt{3\left(\frac{W_2 - W_1}{W_2 + W_1}\right)^2 + 1}}$$

This gives the power-factor as a decimal which multiplied by 100 gives the power factor in per cent. As seen, this formula can also be used without reference to tables of trigonometric functions.

C. W. GUSTAFSON,
Chief Engineer
Mutual Fire Prevention Bureau
Chicago, Ill.

To the Editor of ELECTRICAL WORLD:

C. O. Van Dannenberg asks why not use his equation for per cent power factor? The answer is that from his formula it is impossible to tell whether the power factor is lead or lag.

The most widely used form of his "old friend" is

$$\theta = \tan^{-1}\sqrt{3}\,\frac{W_1 - W_2}{W_1 + W_2}$$

where W_1 is the power read by the meter whose current coil is in the phase leading the phase with no meter by 120 deg.

Assuming the voltage to be the reference vector, the position of the current may be determined as to the particular quadrant, 1, 2, 3 or 4. The numerator is in the form of a sine term and the denominator is in the form of a cosine term. When the numerator is positive the sine is in the first or second quadrant, when it is negative the sine is in the third or fourth quadrant. Similarly the cosine term is positive in the fourth and first quadrants and negative in the second and third quadrants.

Thus if $\tan\theta = \sqrt{3}\,\frac{+\ \cdots}{+\ \cdots}$, current is in first quadrant

if $\tan\theta = \sqrt{3}\,\frac{+\ \cdots}{-\ \cdots}$, current is in second quadrant

if $\tan\theta = \sqrt{3}\,\frac{-\ \cdots}{-\ \cdots}$, current is in third quadrant

if $\tan\theta = \sqrt{3}\,\frac{-\ \cdots}{+\ \cdots}$, current is in fourth quadrant

HOWARD E. HARRY
R2 Box 362, Shreveport, La.

[We did, as Mr. Gustafson infers, receive several letters calling attention to the obvious error in typographical composition. In addition to the correction contributed by him, the expression 50

$$\sqrt{\frac{(1+A)^3}{(1+A)^3}}$$

as in the Von Dannenberg letter as published, should obviously have been

$$50\ \sqrt{\frac{(1+A)^3}{1+A^3}}$$

In connection with Mr. Harry's comment, it is necessary to have some supplementary means either to find out which phase leads by 120 deg. or, conversely, ascertain the "quadrant position of the current." On this see N.E.L.A. Bulletin 278–31 and "Polyphase Meter Connections Checked by Rotation Timing," (ELECTRICAL WORLD, August 12, 1933, pages 204-206.)—EDITORS.]

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Single Ground Wire Not Better Than Two

To the Editor of ELECTRICAL WORLD.

In your issue of February 11, 1939, in reporting the discussions at the A.I.E.E. winter convention, it was stated that I had said that one overhead ground wire was as good as or better than two on transmission lines. This is incorrect.

What was said was that "the similar behavior of these two lines (one with one overhead ground wire and the other with two) indicates that the shielding provided by a single overhead ground wire may be better than has been believed to be the case."

S. K. WALDORF,
Pennsylvania Water & Power Co., Baltimore, Md.

Utility Business Not Interstate

To the Editor of ELECTRICAL WORLD:

As one of your subscribers and readers, I read with interest your editorial in the December 17, 1938, issue of the ELECTRICAL WORLD entitled "Utility Business Interstate." Believing that the title of your editorial is in error, and that some of your statements relative to the Consolidated Edison Company-Labor Board decision are incorrect, I am prompted to write you.

Your editorial commences with the following sentence: "Through the Supreme Court decision in the Consolidated Edison-Labor Board case virtually every electric utility became an interstate agency." Again you say: "By thus characterizing electric utility service as interstate business, the decision goes far beyond merely recognizing the right of N.R.L.B. to regulate labor relations. . . . This is probably one of the most important decisions of the Supreme Court. It would have seemed to have set a precedent, the effect of which can be far reaching not only as regards utilities but many other businesses which thus far had considered themselves to be purely intrastate." You quoted from the opinion as follows: "It cannot be doubted . . . that these activities, while conducted within the state, *are matters of federal concern.* In their totality, they rise to such a degree of importance that the fact that they involve but a small part of the entire service rendered by the utilities in their extensive business is immaterial in the consideration of the *existence of the federal protective power.*" (Italics mine.)

A consideration of the words which I have italicized, as well as a reading of the opinion, shows clearly that the court did not hold that the Consolidated Edison Company of New York was engaged in interstate commerce. The court merely held that its activities were of such federal concern that it was entitled to the federal protective power—treating the Wagner act as a protective measure, intended to foster harmonious relations between employer and employee.

That the court did not hold that the Consolidated Edison Company was engaged in interstate commerce is made

[*Continued on page 128*]

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ELECTRICAL WORLD

MARCH 11, 1939

The Utility's Place in the Appliance Market

The annual appliance sales survey which appears in this issue shows that two-thirds of the dollar volume passes through the hands of the dealer. It also shows that in those cities where both utility and dealer merchandise the utility sales last year fell off more than 30 per cent, while dealer sales were off only 8 per cent. If we were to examine all of the past surveys, this being the ninth, we would find that the utilities' share of the total appliance sales volume was becoming less and less.

Bare facts such as these are apt to lead to erroneous thinking. In spite of the fact that several utility companies in the past few years have withdrawn from direct appliance merchandising, they continue to be the most important single factor in building and maintaining the appliance market.

Dealer sales were maintained last year at a high level, not because of any extra effort on the part of the dealer, but rather because the utilities saw that the dealer could not take the rap of a severe drop in sales. It was the utilities that kept the dealers afloat—that drove business into their stores, business that otherwise would have been credited to the utility sales account.

Had the utilities acted selfishly and shortsightedly the fine dealer distribution that had been built up would have been lost and the business of the manufacturers, not only for the moment, but for the next couple of years, would have been seriously hurt. This maintenance of dealer stability during bad times is one of the major contributions of the utilities to the appliance market.

No, the utilities are not getting out of the appliance market. They are in it stronger today than they ever were. They realize that their responsibility does not stop with their own sales. In fact, they realize that merchandising is but a means to an end—load building. Therefore, the entire market, irrespective of who sells, is their responsibility.

And that is the important thing, the market. Somebody has to watch that—build desire, make people need-conscious. In the automobile field the manufacturer creates the desire to buy a new car. In the food field it is the producer who makes people want to drink tomato juice. But in the electrical appliance field the major part of the demand creation is done by the utility.

Dealers sell what they carry after the desire to try has been created by some other agency. It makes no difference which field one takes. It is the same everywhere. Dealers fill wants.

In the electric appliance field only a handful of manufacturers are able to do a national market development job. Whether or not they sell directly to the utilities, their business depends upon the sales promotion of the local utilities. Too many people have not understood nor appreciated this unique position of the utilities.

Just as long as the utilities want additional domestic load, whether or not they have stores and actively engage in merchandising on their own account, they will be the dominant factor in market promotion. And the utilities will want additional domestic load just as long as it is profitable.

Establishes Method of Measuring Radio Interference

Work of Joint Co-ordination Committee on Radio Reception of E.E.I., N.E.M.A. and R.M.A. Results in Practical Measuring Means

By CHARLES J. MILLER, Jr.
Electrical Engineer, Ohio Brass Company, Mansfield, Ohio

INCREASING interest in the subject of radio interference has been due to the development of modern radio receivers of high sensitivity. The radio has become an integral part of our modern life and any disturbances not belonging to the program are no longer being accepted. While many complaints are directed to the power company, the bulk of the disturbance originates within the home. Even though this is true, the industry is attacking the problem aggressively, minimizing further the small percentage of the annoyance for which it may be responsible.

It has only been in the past decade that insulator manufacturers have been concerned with the problem of radio interference. During the past decade the various manufacturers developed methods of measuring radio interference which enabled them to compare interference-proof and standard insulator designs. However, the methods adopted by the laboratories showed a great lack of uniformity, no two being alike, and this proved a serious handicap in standardizing on test methods and noise level values.

Manufacturers of other electrical equipment had a similar problem of measuring radio interference on their products. The power companies, too, felt the need for a means of measuring disturbances caused by their properties.

To co-ordinate the work on radio interference between the power companies and the various manufacturers of electrical devices the joint co-ordination committee on radio reception of the Edison Electric Institute, National Electrical Manufacturers Association and Radio Manufacturers Association was formed.

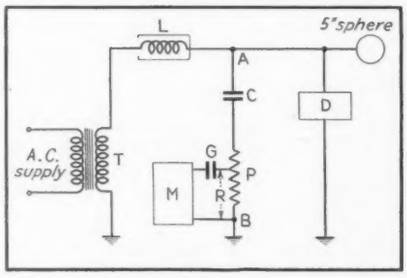


Fig. 1—High-voltage circuit recommended by joint committee

T—Testing transformer.
L—R. F. choke, shielded, not less than 6,000 ohms reactance at broadcast frequencies.
M—Radio noise meter.
C—Coupling capacitor, not more than 60 ohms reactance at broadcast frequencies.
G—Dummy antenna capacitor (21 m.-mfd.)
D—Device under test.
P—Potentiometer, or tapped resistor, 600 ohms resistance, non-reactive.

The device *D* under test is energized by the testing transformer *T* through the radio-frequency choke coil *L*. The choke coil *L* is used to prevent the flow of radio frequency currents in either direction. The measuring circuit *AB* which is connected in parallel with the test specimen consists of a high-voltage capacitor, which offers high impedance to 60-cycle and low impedance to radio frequency, in series with a 600-ohm non-inductive resistor. The reactance of the measuring circuit *AB* should be made less than 60 ohms at radio frequencies. Thus, the device under test, which may be considered as a radio-frequency generator with a very high internal impedance, is working into a non-inductive external load of 600 ohms. Since the voltage drop in the reactance of the measuring circuit is very small, the radio-frequency voltage appearing across the 600-ohm resistor is essentially the same as that appearing across the terminals of the test specimen. As a result, the noise meter *M* is used to measure the noise voltage across the 600-ohm resistor *P* which is equal to the noise across the test piece.

One of the first steps of the committee was to devise a method of measuring radio noise and to establish various standards for these measurements. A revised report was published December, 1935, in a pamphlet entitled "Methods of Measuring Radio Noise," and it is identified by E. E. I. as Publication No. C9. The report establishes a primary standard wave form, defines the units of field strength and noise voltage, gives specifications for the noise-measuring instruments and outlines various coupling circuits to connect the device under test to the noise-measuring instrument.

Radio noise standards

The primary standard wave form is defined as a broadcast frequency sine wave 50 per cent modulated by a 400-cycle sine wave. The unit of measurement of noise voltage is defined as one microvolt r.m.s. of the standard wave form and is called the modulated microvolt. The measuring instrument actually compares the average value of the complex wave form of the radio noise with that of the standard wave form. When each wave form gives an equal response on the output meter of the measuring instrument the two waves are said to be equal, and the noise level in microvolts is equal to the magnitude of the standard wave form.

Certain electrical characteristics of the measuring instrument have been established, including selectivity, fidelity and frequency range (550 to 1,500 kilocycles). The output meter should be critically damped and have

an undamped period of a half second. A standard signal generator is used to produce the standard wave form. The measuring instrument is in effect merely a sensitive radio-frequency voltmeter and is used to compare an unknown voltage with a standard known voltage.

Coupling circuit

The purpose of the coupling circuit is to connect the device under test to the instrument so that the radio-frequency disturbances may be measured while the power-frequency voltages are blocked out. The report gives a number of coupling circuits, but the insulator manufacturer is interested primarily in the one for high-voltage apparatus, shown in Fig. 1.

Since the joint committee on radio reception published its report the method of Fig. 1 has been officially adopted by the high-voltage insulator section of N.E.M.A. and it is now being used in several insulator laboratories.

A radio interference laboratory using the circuit shown in Fig. 1 has been built by the Ohio Brass Company at Barberton and has been in constant use for more than a year testing all kinds of high-voltage insulators. A more detailed circuit of this installation is shown in Fig. 2. The circuit is arranged to show a test on a six-unit string of suspension insulators. Fig. 3 shows the string in place and connected to the source of potential through a shielded radio-frequency choke coil. The drain coil, tuning coil and input end of the transmission line are shown in Fig. 4.

The measuring instrument used in the Ohio Brass Company's laboratory is an a.c.-operated tuned radio-frequency receiver without automatic volume control. A rectifier type voltmeter is used across the output of the receiver. A dummy antenna is used in series with the antenna input. A shielded switch is so arranged that the radio receiver may be connected either to the 600-ohm resistor or to the standard signal generator. The substitution method is used in all measurements since it was found that the calibration of the receiver varied over a period of time. Various parts of the metering circuit are shown in Fig. 5. The report does not specifically mention the tuning of the measuring circuit AB of Fig. 1, but it does specify that the coupling reactance between points A and B shall not exceed 60 ohms.

Extensive tests have been made in the Barberton laboratory with coupling capacitances varying from 500

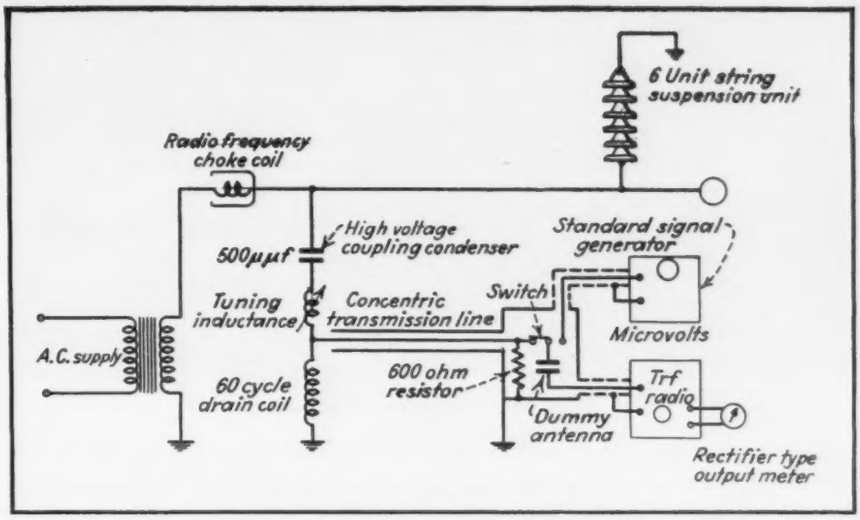


Fig. 2—Test circuit in application

Potential from a test transformer is brought into the room through a wall bushing. The high-voltage condenser consists of a stack of two porcelain coupling condensers, having a net capacitance of about 500 m.-mfd. A small variable inductance is connected in series with the coupling condenser to tune the measuring circuit to resonance at the test frequency. To provide necessary shielding for the lead-in, a concentric transmission line is used having a No. 18 conductor inside a 4-in. metal tube. The 600-ohm resistor is located next to the measuring instrument and is shielded.

A 60-cycle drain coil having a very high impedance to radio frequencies is connected from the input end of the transmission line to ground.

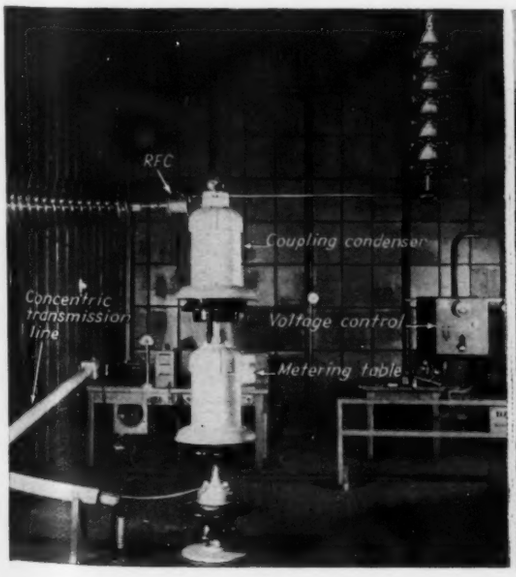


Fig. 3—The test set-up

General view of the Ohio Brass Company's radio interference laboratory, showing the arrangement for a test on a six-unit string of suspension insulators..

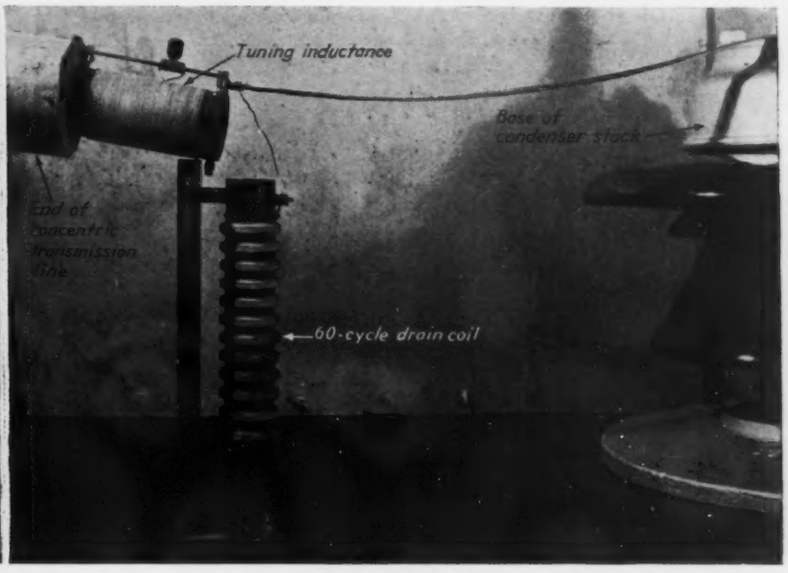


Fig. 4—Detail of test arrangement

Input end of concentric transmission line that connects the high-voltage condenser to the 600-ohm resistor and measuring equipment.

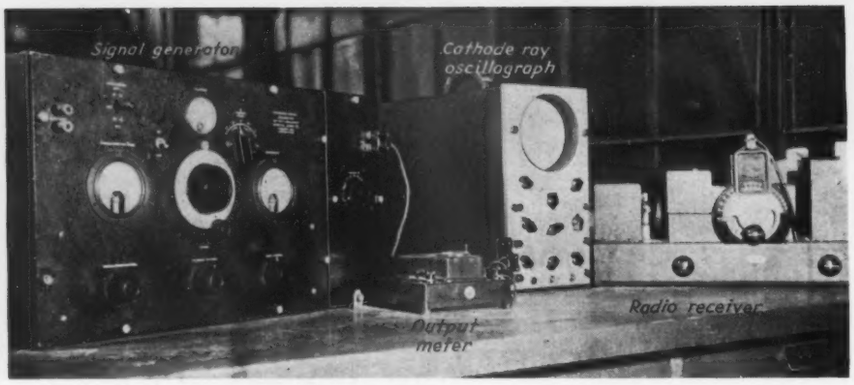


Fig. 5—Radio noise-measuring equipment

to 1,500 m.-mfd. and it has been found that a coupling of 500 m.-mfd. gives identical results with those of 1,000 and 1,500 m.-mfd. when the measuring circuit is tuned to resonance at the test frequency. One advantage gained by using a 500 m.-mfd. coupling condenser is a lower reactive load on the test transformer. Another advantage is the economy involved in using only two coupling condensers instead of a larger number. A disadvantage of using the smaller capacitance is that the circuit must be tuned for each test frequency. However, tests have shown that interference from insulators does not vary much over the broadcast band, and, accordingly, they may be tested at a single frequency. The practice in Barberton is to make the measurements at 1,000 kilocycles, this being the middle of the broadcast band.

Factors influencing choice

A means of measuring radio interference in itself is not the complete story. So that the manufacturer will know that his device is free from noise in the field, he must know the permissible noise level which should not be exceeded in the factory test.

There are several factors which should be considered in attempting to set a standard. Radio reception is generally regarded as satisfactory if the signal strength of the desired station exceeds the strength of the interference by a suitable amount. This quantity is usually referred to as the signal/noise ratio and its magnitude may vary with different listeners. Test results in England show that radio interference is not disturbing if the signal, modulated 80 per cent, exceeds the noise level by 100 times and that if the signal/noise ratio is as low as 5, the program is barely intelligible.

Another factor to be considered is the determination of what constitutes reasonable radio reception. A field strength of 500 microvolts per m. is usually considered as giving satisfactory reception. Certain European countries have agreed that the listener is entitled to noise-free reception if the signal strength is 1,000 microvolts per m., modulated 80 per cent.

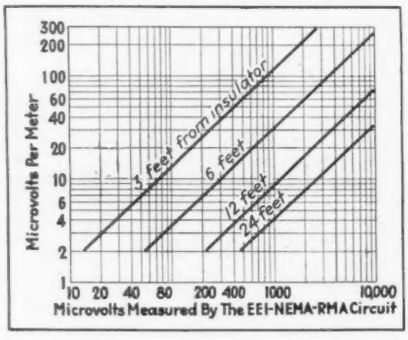


Fig. 6—Shows noise level decrease
An experimental relation between the field strength of radio interference from insulators and its corresponding microvolt noise level.

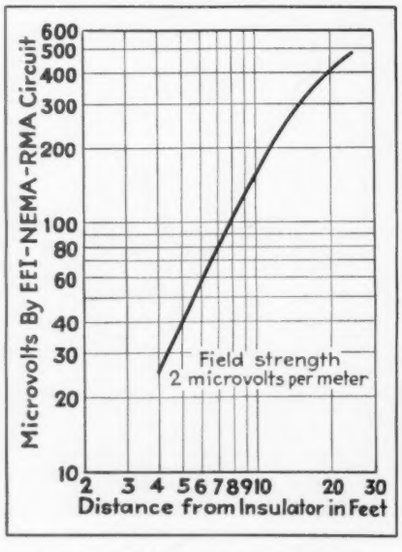


Fig. 7—Noise level vs. distance
Noise level necessary to produce a given field strength at various distances.

In France a signal strength of 1,000 microvolts per m., modulated 30 per cent, has been legally established as the minimum.

Combining field strength with signal/noise ratio gives the maximum permissible interference level. If a level of 1,000 microvolts per m. were to be chosen as the field strength to be protected and the signal/noise ratio were chosen as 100, then the maximum level would be 10 microvolts per m., modulated 80 per cent. French legislation assures the listener of a protection margin of 26 decibels, which corresponds to a noise level of 50 microvolts per m., modulated 30 per cent. In this case the signal/noise ratio is 20.

Noise levels for high-voltage insulators

If a transmission line is to be free from radio interference the insulators should be free from interference at operating voltage. While the noise level which line insulators should meet has not been officially established, a level of 100 microvolts as measured by the E.E.I.–N.E.M.A.–R.M.A. recommended circuit has been suggested.

To gain some conception of what noise values obtained with the E.E.I. method mean in regards to field strength, a series of tests were run to correlate the two quantities. A balanced loop antenna was used to measure the field strength at various distances from an insulator which was being tested by the recommended circuit. Simultaneous readings were taken of field strength and microvolts. The results of these tests, shown in Fig. 6, indicate a numerical relation between field strength and microvolts by the recommended circuit. The field strength is proportional to the microvolts noise level at a fixed distance and it varies approximately inversely as the square of the distance from the insulator. Fig. 7 shows how the microvolt noise level must vary to produce a given noise field strength at various distances from the insulator.

From Fig. 6 a noise level of 100 microvolts gives a field strength of about 3.5 microvolts per m. at 6 ft. In no practical case would there be a receiving antenna within 6 ft. of a high-voltage line. However, it is quite possible that part of a distribution network might parallel the high-voltage line at this spacing and accord-

[*Continued on page 123*]

Instrument Transformer Errors Easily Handled

Simplified View of Accuracy Deviations in Ratio and Phase Angle Allows Ready Calculation of Calibration and Measurement Corrections

By F. E. DAVIS

Commonwealth & Southern Corporation, Jackson, Mich.

FROM study of instrument transformer errors and from a consequent development of a simplified method for dealing with them it appears quite feasible that the important factors involved in the application of these devices to a given case can be effectively taken into consideration without a great deal of effort or involved calculation. Thus the desired degree of metering accuracy will result without the necessity of specially calibrating the instruments or meters used in order to compensate for the transformer deviations. To do this all of the limiting conditions must be known, for most of the factors to be considered are variables.

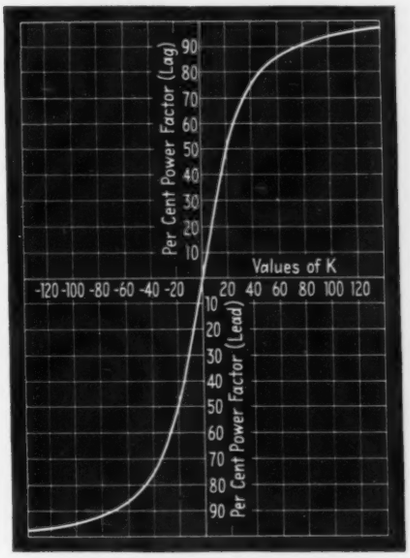
The proposed method, which employs the fact that under many conditions of use certain of the so-called instrument transformer "errors" tend to balance each other, may be used to compute readily the effect on the accuracy of measurement, under given conditions, of these "errors." It also may be used to compute necessary calibration corrections when desired and for specification purposes in the purchase of new transformers. Thus the ability of a transformer on hand to meet the requirements of a given situation is easily determined.

Derivation of formula

Let Θ = Power factor angle of current and voltage to be measured

ϕ = Phase angle of transformer (leading angle, plus sign)

RCF = Ratio correction factor



Values of K

This is simply a cotangent curve with the Θ angle value (vertical axis) stated in per cent power factor and the cotangent value (horizontal axis) multiplied by 34.4, which is the reciprocal of 100 times the factor required to convert the phase angle ϕ from minutes to radians when ϕ is less than one degree.

R = % Ratio error of transf.

$$= (\%\ RCF - 100)$$

$$= \frac{\text{True ratio}}{\text{Marked ratio}} \times 100 - 100$$

M = % Meter error

$$= (\%\ \text{Accuracy} - 100)$$

Then for a current transformer:

E is the impressed voltage

I is the current measured

I' is the transformer secondary current

Since $\dfrac{\text{Measured power}}{\text{Actual power}}$ = Accuracy

Then $\dfrac{EI' \cos (\Theta - \phi)}{EI \cos \Theta} \times 100$

$$= \%\ \text{Accuracy} = 100 + M$$

But $I' = \dfrac{I \times 100}{\%\ RCF} = \dfrac{I}{(100 + R)} \times 100$

So $\dfrac{100 \times 100 \times \cos (\Theta - \phi)}{(100 + R) \cos \Theta} = 100 + M$

$$\frac{\cos (\Theta - \phi)}{\cos \Theta} = \frac{\cos \Theta \cos \phi + \sin \Theta \sin \phi}{\cos \Theta}$$

$$= \frac{(100 + M)(100 + R)}{10{,}000}$$

Where $\cos \phi = 1$, very nearly

and $\sin \phi = \phi$ measured in radians very nearly

$= 0.000291\ \phi$ when ϕ is in minutes

$$1 + \frac{\sin \Theta}{\cos \Theta} \times 0.000291\ \phi$$

$$= \frac{10{,}000 + 100M + 100R + MR}{10{,}000}$$

But $\dfrac{MR}{10{,}000}$ is very small and may be neglected.

Thus $1 + \dfrac{\sin \Theta}{\cos \Theta} \times 0.000291\ \phi$

$$= 1 + \frac{R + M}{100}$$

and $\phi = \dfrac{\cos \Theta}{\sin \Theta} \times \dfrac{R + M}{0.0291}$

$$= 34.4 \cot \Theta\ (R + M)$$

$$= K\ (R + M)$$

Where $K = 34.4 \cot \Theta$

See accompanying curve for values of K.

Since at unity power factor the ratio error equals the meter error (assuming zero or a relatively small phase angle) it is necessary that R be equal to or less than M if it is desired to maintain the same accuracy limits for the entire range of power factors between the power factor for which the value of K is chosen and 100 per cent or unity. Actually, under the assumptions made, at unity

power factor K is infinite, so $R = -M$. (Note that a positive ratio error gives a negative meter error.)

For a potential transformer:

$$\frac{\text{Cos } (\Theta + \phi)}{\text{Cos } \Theta} = 1 + \frac{R + M}{100}$$

This reduces to $\phi = -K (R + M)$

Where also $K = 34.4 \text{ Cot } \Theta$

Thus these two equations may also be written:

For C.T. $M = \frac{\phi}{K} - R \quad R = \frac{\phi}{K} - M$

For P.T. $M = -\frac{\phi}{K} - R$

$$R = -\frac{\phi}{K} - M$$

Application to current transformers

Suppose the ratio errors of a current transformer at 10, at 20 and 100 per cent load are, respectively, 1, 0.7 and 0.5 per cent at the approximate burden under which the transformer will operate. Also suppose the power factor of the measuring element current and voltage varies between 50 per cent lag and unity (the maximum limits) and the maximum desired meter error is = 1.0 per cent:

Then from the curve, $K = 20$ for 50 per cent of lag and taking the two extreme values of R and M

$\phi = + K (R + M)$

10% load $\phi = 20 (1.0 \pm 1.0)$
$= + 40'$ and 0 as boundary values

20% load $= 20 (0.7 \pm 1.0)$
$= + 34'$ and $- 6'$

100% load $= 20 (0.5 \pm 1.0)$
$= + 30'$ and $- 10'$

Therefore, if the measured phase angles fall within these limits, and since R is equal to or less than M, the transformer may be used to give the desired results over the specified power-factor range.

Again, suppose that at a given burden and load current the transformer ratio error is plus 0.5 per cent, the phase angle is plus 30 minutes and it is desired to know the meter errors at power factors, say, of 70 per cent lag and lead and of unity.

At 70% p.f. lag:

$$M = \frac{\phi}{K} - R = \frac{30}{34} - 0.5$$

$$= 0.88 - 0.5 = + 0.33\%$$

At 70% p.f. lead: $M = \frac{30}{34} - 0.5$

$$= - 1.38\%$$

At unity p.f.: $M = \frac{30}{\text{Infinity}} - 0.5$

$$= -0.5$$

Application to potential transformers

Potential transformers may be handled in a similar manner to current transformers except that the sign of the phase angle is opposite, as will be noted from the formula:

$$\phi = - K (R + M)$$

Combined current and potential transformers

If the combined phase angle is taken as the phase angle of the current transformer *minus* the phase angle of the potential transformer and the combined ratio errors taken as the ratio error of the current transformer plus the ratio error of the potential transformer (and it is very nearly), these two resultant quantities can then be handled exactly as if for a current transformer.

For instance:	Phase Angle	Ratio Error
C.T.	+ 8′	+ 0.7
P.T.	+ 11′	− 1.2
Combined...	− 3′	− 0.5

Then M at 50% p.f. $= \frac{-3}{20} - 0.5$

$$= -0.65\% \text{ etc.}$$

Application to instrument transformer specifications

Suppose that it is desired to limit the maximum ratio error of a current transformer to ± 0.25 per cent as in present highest accuracy specifications. This would infer an attempt to limit meter accuracy to some value close to the same value, but unless the phase angle values are specified in proper relation to ratio errors the desired result is not accomplished.

For instance, at 50 per cent power factor lag of measuring element and a ± 0.5 per cent maximum meter error the phase angles would have to be in the following limits:

$\phi = 20 (\pm 0.25 \pm 0.5)$

If $R = + 0.25$ $\phi = + 15'$ and $- 5'$
If $R = - 0.25$ $\phi = - 15'$ and $+ 5'$
If $R = 0$ $\phi = + 10'$ and $- 10'$

To maintain the ± 0.5 per cent meter error for any value of R between ± 0.25 per cent the phase angle range must be limited to ± 5 minutes. It would, therefore, appear better to limit the ratio errors so that under all usual conditions they would have the same sign and the phase angles adjusted to have the proper relation. For current transformers a negative ratio error and for potential transformers a positive ratio error seem to offer the better possibilities when present-day transformers are considered, but in general, at present, the opposite is true. However, these points are somewhat irrelevant to the discussion as good results may be otherwise obtained.

In the case taken for a current transformer a specification such as shown in the panel at left could be written:

Such specification would, under usual metering conditions, limit the effect on accuracy from each transformer to ± 0.5 per cent or a combined effect of ± 1.0 per cent in the power factor range from 50 per cent lag to unity.

Suggested Specification for Instrument Transformers

For a current transformer:

% Load	Burdens	Phase Angle Limits in Minutes	% Ratio Error Limits
10, 20 & 100	X^* and Y^*	20 ($R \pm 0.5$)	± 0.25
10, 20 & 100	Z^*	20 ($R \pm 1.0$)	± 0.5

Where R = % Ratio error at a given condition

*Burdens $X = 2\frac{1}{2}$ v.a. @ 0.9 p.f.
$Y = 15$ v.a. @ 0.9 p.f.
$Z = 50$ v.a. @ 0.5 p.f.

For a potential transformer:

% Normal Voltage	Burdens	Phase Angle Limits in Minutes	% Ratio Error Limits
100	W^* and X^*	− 20 ($R \pm 0.5$)	± 0.25
100	Y^*	− 20 ($R \pm 0.5$)	± 0.5
100	Z	− 20 ($R \pm 1.5$)	± 1.5
100 & 90	W^*, X^*, and Y^*	− 20 ($R \pm 1.0$)	± 0.5

Where R = % Ratio error at a given condition.

*Burdens $W = 5$ v.a. @ 0.3 p.f.
$X = 15$ v.a. @ 0.1 p.f.
$Y = 50$ v.a. @ 0.1 p.f.
Z = Rated @ 1.0 p.f.

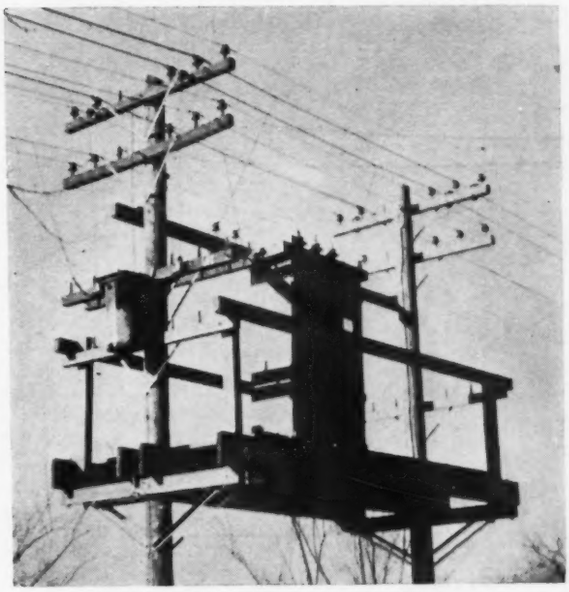
Capacitor Earns Its Cost in Four Months

By E. M. CONWELL and WALTER DOLDE
General Superintendent *Electrical Engineer*
Albuquerque Gas & Electric Company, Albuquerque, N. M.

THE direct gain (*i.e.*, reduced feeder energy losses and increased revenue) from a recent installation of Pyranol capacitors amounted to $2,266 in one year, or a total 50 per cent greater than the cost of the installation ($1,440). In addition the released capacity (feeder, substation and generator), if evaluated on a unit cost basis, represented investment on which 12.5 per cent carrying charges would amount to an estimated $1,824. It is common practice with many operators, in evaluating the benefits from capacitors, to add the direct annual gains and the annual values of released capacity, since these benefits all occur simultaneously and considering the availability of the released kva. is worth something. From this point of view, therefore, the capacitor investment in this case would be liquidated in less than four months.

Other operators have a somewhat different point of view and they consider the economic value of the capacitors to be the saving in annual carrying charges on the delayed investment in all necessary system equipment to produce as nearly as possible the same benefits of reduced losses, increased revenue and additional capacity as is produced by the capacitors. From this point of view, even ignoring losses and revenue, only a cursory analysis was necessary to show that charges saved on delayed investments liquidated the capacitor costs in a still shorter time than may be shown by the unit cost method of analysis.

These startlingly large savings resulted from a 180-kva. capacitor installation on a 2,400-volt feeder out of the 4,875-kva. gas plant substation (Fig. 1). The average daily kva. load served by this feeder is shown plotted in Fig. 2. Voltage conditions on this feeder were carefully recorded at various points (Fig. 3). These data were recorded at a peak load of 870 kw. and a line power factor of 89 per cent.



180-kva. Pyranol capacitor on 2,300-volt 3-phase line

It can be seen from this diagram that about 7,650 ft. from the substation (at point "A," Fig. 1) the peak load voltage dropped to 7.6 per cent below the normal of 2,400 volts. This drop became greater, of course, farther out on the feeder. With a power factor of 89 per cent, it was obvious that a large percentage of this voltage drop was due to the reactive amperes, which do no useful work. Under such conditions a shunt capacitor is the most natural and logical solution to the voltage problem.

Accordingly, a 180-kva., 2,300-volt pole-type capacitor was installed at point "A," where it was most desired to correct the rather serious under-voltage.

After the capacitor installation the peak load power factor was raised to

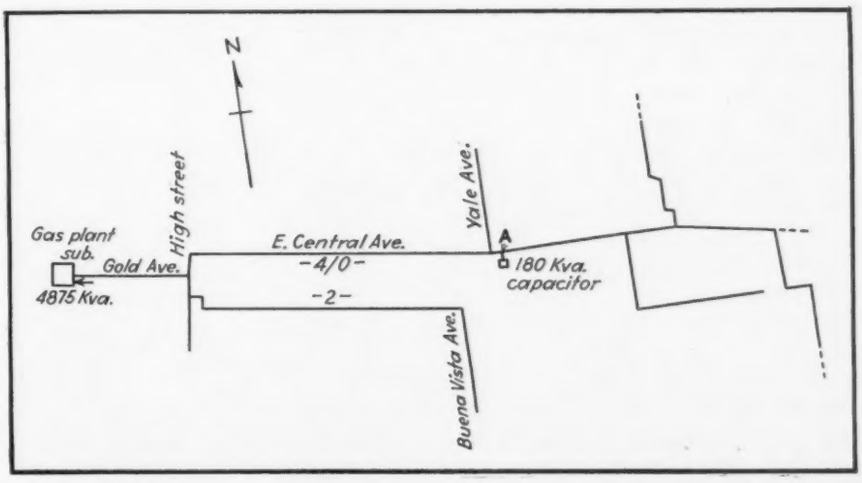


Fig. 1—Albuquerque's feeder No. 9 served a 1,000-kva., 2,300-volt peak load better with capacitors at A. Extreme run about 3 miles

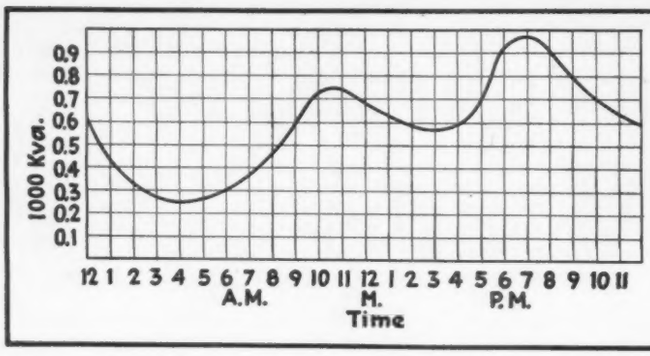


Fig. 2—Approximate daily (r.m.s.) kva. of 560 served by feeder with characteristic peak of 970 kva.

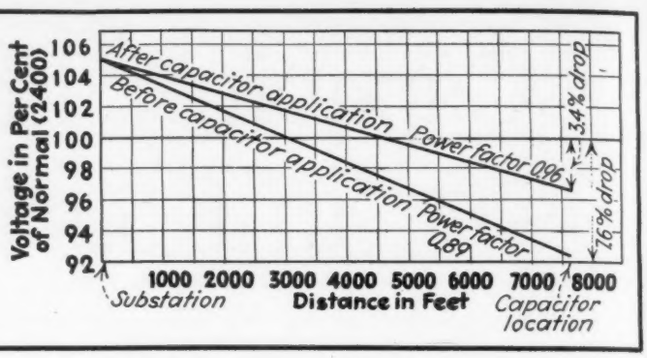


Fig. 3—Excellent voltage established by capacitor correction on 970-kva. peak load

96 per cent and the voltage at "A" was increased to only about 3.4 per cent below normal, which is approximately 50 per cent improvement, and well within the values which are generally accepted for good electrical service.

As shown by the chart in Fig. 3, this gives excellent voltage conditions along the entire feeder, since the corrective effects of a capacitor are effective from the installation all the way back to the substation.

Reactive kva. reduced

The reduction of reactive kva. is well illustrated by a comparison of the curves in Fig. 4, which show daily reactive loads at point "A" before and after the installation of the capacitor.

With the improved conditions (Fig. 3) all customers are supplied with a voltage which assures efficient and highly satisfactory operation of all electrical appliances. This correction of the average voltage level also eliminates a considerable loss of revenue, which was previously experienced due to undervoltage.

One of the purposes of a capacitor application is to gain added capacity of feeder, substation and generators, by removing the useless reactive or out-of-phase amperes. This released capacity must be evaluated and the carrying charges on this invested capital credited to the capacitor installation. The cost values assumed in the following calculations are considered average conservative values which would apply in this case. The following is a summary of the first year savings made by this application:

1. Released feeder capacity (carrying charges) $657.00
2. Released substation capacity (carrying charges) 147.00
3. Released generator capacity (carrying charges) 1,020.00
4. Saving in revenue due to maintenance of proper voltage level 1,740.00
5. Saving in copper losses 526.00

The approximate installed cost of the capacitor was $1,440. The above savings are based on the calculations and the unit costs shown below:

Released Feeder Carrying Capacity—Released feeder capacity on feeder No. 9 = 210 kva.

Evaluated at $25 per kva. and 12.5 per cent carrying charges, the annual saving becomes 210 × 25 × 0.125= $657.00.

Released Substation Capacity—Substation capacity = 4,875 kva.

For calculating purposes, it was assumed proportionate capacitor kva. is applied to other feeders leaving the substation.

Released substation capacity for capacitors on feeder 9 = 78.4 kva.

This kva. evaluated at $15 per kva. and 12.5 per cent carrying charge gives a saving as follows: 78.4 × 15 × 0.125 = $147 annual saving from released substation capacity.

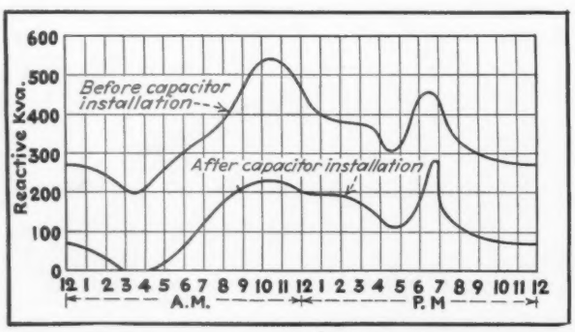


Fig. 4—Reactive kva. substantially reduced by corrective installation at point "A" of Fig. 1

Released Generator Capacity—Released generating capacity due to capacitors on feeder No. 9 = 68 kva.

The generator capacity released is evaluated at $120 per kva. and with carrying charges of 12.5 per cent per year become 68 × 120 × 0.125 = $1,020 per year carrying charges saved.

Saving in Feeder Copper Losses—The saving in feeder copper losses was found to be 52,600 kw.-hr. per year.

This saving in losses evaluated at 1 cent per kilowatt-hour amounts to $526 per year. Loss savings in other parts of the system were not evaluated.

Increase in Revenue—The increase in revenue-producing load was found to be 87,000 kw.-hr. per year. This load calculated at an average value of 2 cents gives an increase in revenue of $1,740 per year.

Voltage Condition Calculations—The point of capacitor application was considered as approximately the load center of the feeder.

Voltage rise was found to be approximately 4 per cent by actual measurement. This rise was found by measuring the voltage at the capacitor installation both with and without the capacitor connected.

The drop was found to be 12.6 per cent at 970 kva., which is peak load. This compares with an actual measured drop of 6.7 per cent at 520 kva. load.

The drop below a normal of 2,400 volts at the load center thus is 12.6 — 5 = 7.6 per cent, since the voltage at the substation is maintained 5 per cent high during peak loads.

This drop of 7.6 per cent minus the voltage rise due to the capacitor becomes 7.6 — 4 = 3.6 per cent drop at the load center with peak load on the feeder.

Load Building Progress in 1938

9th APPLIANCE SALES SURVEY

The Merchandising and the "Non-Merchandising" Companies—Utilities' Costs to Add New Revenue —Appliance Sales Volume of Dealers and Utilities

By HENRY G. DOOLEY
Associate Editor

THE past year was a year of minus signs in terms of appliance sales by utilities and their co-operating dealers. But the momentum of effective load-building programs in recent years brought added gains in usage and revenue of utility customers.

Such are the conclusions derived from confidential data presented by 140 utility companies—the largest number ever gathered together for a utility sales survey—embracing appliance sales on one hand and load-building results on the other.

Again this year this survey embraces merchandising and "non-merchandising" utilities, results of dealers' sales under both types of utility policy, includes combination as well as straight electric operations and complete cost data.

The 140 utility companies which co-operated to make this survey possible render service to 63 per cent, or 14,930,961, of the nation's domestic meters.

How about dealers?

A moot question in the utility business today revolves about the ability of electrical dealers to take over a part of the appliance sales and load-building job and 1938 facts on this question are presented.

As will presently appear, appliance sales volume per customer dropped to just about the same degree where dealers did all the selling as it did where utilities and dealers together did the selling.

However, it will be noted from analysis of total sales volume that merchandising utilities registered a loss of 32 per cent, whereas their co-operating dealers reported a loss of only 8.2 per cent in sales. This may permit the surmise that when the going became tough the utilities relinquished a larger proportion of the business to their dealers and took the gaff themselves.

Furthermore, it will be noted that appliance sales per customer were running along at almost twice the volume in the territories of the "non-merchandising" companies as they were in the other company territories.

To keep the ball rolling, and rolling as has been seen, for dealers, all of the companies spent more money on customer sales and promotion than ever before and the "non-merchandising" group, moreover, increased its own sales force 7 per cent during 1938.

Net results

To complete these high spots on latest results of appliance sales and load building we may summarize the economics by stating (1) that utilities which share the load-build-

RESULTS OF 1938 LOAD-BUILDING PROGRAMS

Based upon reports from 129 utility companies with 14,039,626 domestic (residential and farm) customers.

1	Companies' merchandise sales volume dropped .	32%	4	Average usage went up	5.9%
2	Dealers' merchandise sales volume in same territory dropped	8.2%	5	Average annual bill went up . .	1.9%
3	Merchandise sales per customer by utilities and dealers dropped. . .	23%	6	Utilities sales and promotional expenses per customer went up . .	12%

Domestic Appliance Sales and Promotion by Utilities

Table I—Total sales of household appliances by 129 power companies during the full year 1938, together with estimates of dealer sales of refrigerators, ranges and water heaters in the same areas.

Company	Domestic Consumers Dec. 31	Average Annual Domestic Kw.-Hr. Consumption		Av. Rev. per Consumer	Av. Price, Cents per Kw.-Hr.	REFRIGERATORS					RANGES					WATER HEATERS				
						Units Sold By Power Cos.		Units Sold By Dealers Pwr. Co. Est.		Saturation %	Units Sold By Power Cos.		Units Sold By Dealers Pwr. Co. Est.		Saturation %	Units Sold By Power Cos.		Units Sold By Dealers Pwr. Co. Est.		
	1938	1938	1937	1938	1938	1938	1937	1938	1937	1938	1938	1937	1938	1937	1938	1938	1937	1938	1937	
I—NORTHEAST—North of the Ohio River, East of the Mississippi River																				
1	836,282	869	833	33 68	3 87	3,782	4,725			52	1,411	547			1	239	0			
2	H 782,149	677	642	34 70	5 13	4,665	8,029				243	276				35	53			
3	575,091	959	874	36 11	3 77	3,347	4,997	39,579	63,003		3,326	4,658	2,801	1,918		3,040	4,759	731	493	
4	H 568,825	974	910	33 93	3 49	1,844	3,525			57	6,650	10,063	6,142	5,449	13	655	1,174	77	15	
5	H 527,002	612	589	33 50	5 47	6,077	9,184				2,392	3,733				143	179			
6	H 352,929	1,088	1,004	33 89	3 12	4,830	12,093			49	2,728	6,911	6,919	13,141	21	824	2,928	690	1,703	
7	HQ 339,187	Q 706	Q 666	Q 39 12	Q 5 54	2,226	3,580	15,505	18,872	47	1,524	2,812	2,315	2,106	7	371	854	327	312	
8	336,041	702	692	36 20		3,200	4,540				1,029	2,054	764	577	5	166	329	76	54	
9	H 304,376	940	914	37 88	4 03	935	2,006	17,500	33,000	64	10	9	100	126	1	11				
10	H 276,947	Q 916	Q 841	43 57	4 75	1,811	4,558	17,821	23,469	65	1,302	2,346	1,292	1,985	4	674	895	282	348	
11	H 238,695	816	789	32 89	4 03	2,260	3,889				325	1,122				139	273			
12	231,980	1,119	1,083	33 27	2 99			14,424	19,397	43	1,769	2,414	3,680	5,319	16	691	594	175	105	
13	220,425	842	780	31 94	3 79			12,874	21,465	44	3,239	4,488	2,219	2,129	12	841	1,694	567	543	
14	213,676	1,004	913	30 93	3 08	1,150	1,250	8,050	12,250	36	950	1,120	1,700	1,650	7	600	560	300	420	
15	174,345	1,093	1,008	36 02	3 30	2,096	6,665			43	1,403	3,358		2,310	16	450	1,742		276	
16	H 170,000	912	847			742	1,290	15,500	28,714	69	454	690	326	188	15	132	134	56	19	
17	H 143,708	977	913	43 81	4 50	2,485	5,744	3,000	6,000	54	1,351	1,884	425	550	11	780	1,059	180	225	
18	H 118,387	737	693	35 87	5 00	1,193	1,754	8,904	11,166	45	161	307	431	67		119	177	118	21	
19	H 117,203	655	618	32 52	4 96	1,398	2,683	2,796	5,366	45	736	1,104	75	110	45	250	206			
20	H 108,989	791	737	40 35	5 10	970	2,168				101	38				11	10			
21	H 101,822	779	713	37 51	4 80	100	200	5,000	8,547	45	115	204	1,385	1,877	9	85	185	415	675	
22	H 89,342	776	737	35 49	4 57			5,480	9,198	53	437	1,120	284	191	4	118	178	25	26	
23	H 85,827	774	730	49 06	6 34	2,633	3,133	3,500	4,000	42	885	996	125	150	7	398	373	15	15	
24	82,268	786	735	41 57	5 29			2,039	3,419	26	1,604	1,719	770	870	19	453	560	210	265	
25	75,472	855	845	42 54	5 00	261	1,135	3,534	6,283		178	968	598	865		129	825	157	249	
26	H 73,135	768	734	36 53	4 76	972	2,021	2,437	3,648	29	865	1,702	367	369	12	325	826	145	158	
27	H 72,726	702	649	34 20	4 87	1,100	1,611	2,132	2,246		910	1,203	230	146		402	574	39	23	
28	71,313	648	601	28 84	4 45			992	2,078	29	453	650	455	432	8	32	81	14	17	
29	70,926	927	827	37 56	4 00	590	873	700	1,000		626	725	50	50		466	524	10	10	
30	63,792	888	829	38 11	4 29			2,563	4,919	29	1,036	1,716	724	548	17	202	441	154	138	
31	H 59,685	737	678	35 03	4 75	1,123	1,990			27	681	838	249	300	8	531	622	110	140	
32	H 59,063	1,004	939	35 11	3 50	815	1,820			47	596	1,133	24	79	8	194	391	6	32	
33	H 58,837	694	638	35 61	5 13	948	1,563	1,715	2,043	35	694	956	526	537	12	245	357	66	59	
34	55,106	697	673	38 65	5 55	607	1,053	2,000	3,500	35	158	615	50	200	12	14	46			
35	H 44,738	507	495	31 72	6 01	468	1,248	836	2,087	39	60	129	34	29	3	13	6			
36	H 44,146	854	801	43 31	5 05	54	45	1,600	2,205	47	92	90	500	949	19	63	66	100	237	
37	43,081	916	855	39 96	3 92	955	2,199			47	392	826	215	212	9	110	259	39	38	
38	40,999	760	726	P 40 58	4 70	601	1,038	1,893	2,898	75	89	224	177	133	10	9	4	0	0	
39	40,868	935	866	39 61	4 24			2,083	3,938	46	596	1,066	535	619	17	163	423	152	196	
40	36,174	784	753	35 13	4 44	339	295	1,644	2,401	42	308	513	414	398	20	164	222	92	35	
41	H 36,089	747	682	30 44	3 92	154	196	2,911	4,272	52	139	180			9	11	8			
42	H 33,014	772	761	32 41	4 20	301	722			42	294	515	88	85	6	83	173			
43	H 26,125	779	745	34 98	4 49	212	580	1,557	3,437	40	76	275	65	52	5	38	133	8	27	
44	20,511	853	739	32 62	3 82	10	35				12	63	842	897			24	259	198	
45	H 16,501	659	615	34 16	5 20	303	305	699	756	36	169	247	139	100	13	59	95	8	9	
46	13,994	705	651	35 68	5 06	119	260	641	1,180	50	18	16	2		1					
47	13,656	697	628	35 91	5 14	100	185	446	553	29	224	281	95	98	18	78	118	14	20	
48	H 61,213	795	740	38 75	4 88	1,893	3,073				957	1,223				244	265			
49	H 36,054	736	667	32 90	4 50	1,008	1,568	2,169	1,725	48	733	836	379	287	19	427	282	78	73	
50	H 33,537	545	510	31 30	5 76	183	231	260	300	22	43	42	50	50	1	0	7	0	0	
51	H 33,351	924	864	43 78	4 74	443	842	2,200	4,000	53	85	111	70	125	6	13	19	4	2	
52	29,064	623	597	26 04	4 18	75	117	1,424	1,805		2	1	25	30			1			
53	H 38,000	476	458	22 11	4 60	67	471	789	2,170		4	22	21	20		0	0	0	0	
54	27,000	829	784	38 72	4 67	235	408	1,718	2,500	52	211	266	199	127	10	36	29	10	11	
55	33,000	697	654	45 84	6 56	351	388	900	1,100		107	99	60	50		35	30	8	6	
56	24,000	802	743	32 31	4 03	337	604	2,000	2,114	82	56	50	15	10		1	1			
57	97,669	862	775	35 53	4 12	954	2,148	4,000	7,000		462	1,274	2,042	3,109		16	33	4		
58	86,077	876	828	42 66	4 87	3,606	6,342	1,600	3,300	65	1,485	1,581	340	50	3	43	28	0	0	
Total	8,564,412	Y 803	Y 751	36 20	4 50	66,928	121,379	218,415	343,724	Y 44	46,956	74,409	41,333	51,669	Y 11	15,361	25,829	5,723	7,173	
II—SOUTHEAST—South of Ohio River, East of Mississippi River																				
60	H 168,500	880	830	32 30	3 67	3,615	5,705			60	2,566	3,236			17	854	1,033			
61	H 167,952	1,399	1,313	40 95	2 96	3,948	9,258		1,799		2,480	6,476	2,061	332	23	1,670	4,106	761	179	
62	135,576	862	830	33 26	3 86	0	0	6,966	11,612	51	1,550	1,944	1,527	1,281	11	366	452	235	198	
63	123,660	1,461	1,353	40 09	2 75	2,313	5,080			61	911	3,542	735	1,723	27	586	2,240	168	551	
64	Q 126,709	Q 1,141	Q 1,096	Q 42 40	Q 3 72			12,123	15,311	67	886	1,790	754	1,354	14	236	643	55	78	
65	115,415	1,262	1,205	38 75	3 07	992	4,122			64	1,180	2,995	2,076	1,896	23	652	1,693	697	898	
66	H 100,753	1,156	1,102	58 94	5 10	207	194	14,916	16,014	56	558	600	5,034	4,445	21	326	419	2,518	2,197	
67	H 86,243	713	708	35 20	4 94	1,307	2,375	3,793	5,500	51	199	181	60	50	2	19	10	0	0	
68	H 83,924	822	739	30 51	3 71	61	102	6,136	9,280	50	76	68	39	40		33	44	8	7	
69	H 82,338	728	668	*36 19	4 96	809	1,187	4,062	6,109	47	669	1,007	521	466	8	269	391	116	68	
70	35,637	718	676	40 61	5 66	546	746	739	826	38	707	655	102	104	13	334	352	14		
71	33,206	902	834	35 90	3 98	725	1,860			46	338	662	42	27	11	165	517	23	24	
72	H 30,743	678	633	34 26	5 06	33	427	1,599	2,301	51	10	296	248	176	9	1	26	16	15	
73	28,022	857	804	33 60	3 92	0	0	1,080	2,045	47	215	309	45	60	5	73	99	7	4	
74	H 21,816	1,326	1,212	44 46	3 35	304	1,038		271	55	224	428		127	19	148	298		54	
75	19,899	723	678	29 63	4 10	0	0	757	1,717	46	179	385	72	69	7	31	91	13	5	
76	H 17,039	965	892	38 76	4 01	127	562	1,500	2,034	70	43	152	225	172	10	29	50	40	37	
77	H 13,789	1,226	1,177	46 26	3 77	222	558		1,049	59	178	426		151	21	76	310		61	
78	H 13,655	1,180	1,079	53 79	4 55	79	115	611	1,273	77	72	126	233	524	28	73	135	136	405	
79	4,942	1,032	989	35 15	3 41	0	0	408	986	59	103	156	149	174	27					

* Estimated. A Outside salesmen only. B All lamps. C At net prices. D District representative plan. E Ranges and water heaters only. F Excludes lighting specialists. G Rental purchase plan. H Company has gas customers. I Combined with gas expense. J Includes dealers' sales. K Includes gas

nd their Local Dealers for the Full Year 1938

Also, comparisons of these sales totals with the year 1937, with data on average consumption, rates, revenues, saturations, sales totals, sales people and direct sales and promotional expense in building domestic load — embracing over fourteen million consumers.

Washing Machines Units Sold By Power Cos.		Saturation Washing Machines, %	Ironing Machines Units Sold By Power Cos.		Saturation Ironing Machines, %	Vacuum Cleaners Units Sold By Power Cos.		Saturation Vacuum Cleaners, %	Total Sales of All Appliances By Power Cos. (Dollars)		Total Sales of All Appliances By Dealers (Dollars)		Power Co. Sales Per Consumer ($)	Annual Rev. Inc. from Power Co. Sales (Dollars)	No. Power Co. Salesmen and Women Building Domestic Load		Consumers Per Sales Person	Power Co. Direct Sales Expense ($)	Power Co. Advtg. & Promotion Exp. ($)	Sales & Adv. Exp. Per Consumer ($)	Company
1938	1937	1938	1938	1937	1938	1938	1937	1938	1938	1937	1938	1937	1938	1938	1938	1937	1938	1938	1938	1938	
I—NORTHEAST—North of the Ohio River, East of the Mississippi River																					
327	2,953	63	567	1,061	7	6,238	6,817	80	O 3,792,050	O 4,158,353			4 53		F 582	F 652	1,440	1,736,691	484,632	2 65	1
1,000	12,368		1,222	2,227		4,297	6,598		2,701,653	4,443,371			3 45		351	402	2,220				2
437	2,101		369	536		814	1,115		2,424,337	2,538,359			4 20	401,900	271	274	2,120				3
763	3,822		196	260					C 1,350,281	C 2,156,000			2 37		65	69	8,750		693,551		4
713	4,595		621	961		3,134	3,786		2,221,000	3,069,000			4 20		195	190	27,000				5
			761	1,309		1,607	3,253		1,913,244	4,048,951			5 42		(F)	(F)					6
741	1,994	88	250	416	1	1,441	1,447	62	1,123,655	1,660,690	9,107,819	7,862,717	3 31	161,272	345	345	980	752,742	435,320	3 50	7
768	1,879		275	437		2,045	1,991		1,214,802	1,538,646			3 62		A 52	A 57	6,450	350,000	200,000	1 64	8
997	2,035	65	176	415	12	959	1,962	68	692,819	1,193,685			2 27	177,366	65	58	4,700	171,019	172,576	1 13	9
985	1,844	76	418	524	10	1,400	1,892	86	1,105,525	1,916,730			3 98	210,000	148	188	1,870				10
942	3,028		139	317		1,887	2,938		1,306,731	1,932,095			5 57		228	220	1,050				11
									302,260	340,465	3,216,000	3,765,920	1 30	135,116	88	88	2,620				12
									K 431,794	K 699,759			1 96	E 150,244	70	69	3,150		L 69,000		13
642	1,003	80	58	169	6	1,068	1,581	65	753,607	976,630			3 54		75	75	2,840				14
2266	2,321		633	1,264		794	1,689		1,127,826	2,500,859			6 46		F 191	F 289	913				15
804	972	62	126	245	6	1,197	2,178	57													16
1689	1,146	75	265	319	12	663	609	83	1,201,871	2,190,304			8 35		136	148	1,057	* 510,000	45,280	3 87	17
240	329		38	31		49	178		309,758	462,677			2 61	63,624	55	55	2,160	88,740	75,394	1 39	18
1627	1,078	70	132	124	1	671	629	67	603,000	*825,000	802,150	1,334,528	5 15	99,560	87	115	1,340				19
454	427		186	187					283,709	481,875			2 61		25	25	4,350				20
675	30	57	54	15	53	4			72,767	125,047	1,607,100	2,761,185	0 71	11,455	10	18	10,182	26,000	66,000	0 90	21
26		55				6		60	69,210	119,672	2,612,825	3,518,172	0 77	15,000	12	39	7,450	33,470	50,000	0 93	22
15	681	824	46	330	262	3	679	795	65	858,299	986,711			10 00	203,380	49	48	1,745	(M)	(I)		23
265									K 177,256	K 210,004			2 17	K 75,864	27	25	3,040		L 31,000		24
249	37	141		14	51				84,014	411,384	785,320	1,262,640	1 11	16,454	8	34	9,430				25
158	482	367		141	143		401	1,077		497,817	898,796			6 80	62,171	50	85	1,460	115,874	41,134	2 15	26
23	832	1,178		159	267					659,305	799,059			9 05		39	44	1,860	40,676	26,006	0 92	27
17										K 57,763	K 97,966			0 81	K 17,588	18	17	3,960		L 18,000		28
10	273	337		97	90		280	491		357,820	450,665	400,000	400,000	5 03	61,288	40	45	1,770	61,000	76,637	1 94	29
158										K 146,959	K 258,515			2 30	K 45,376	22	22	2,900		L 24,000		30
140	308	463	69	63	104	3	905	1,342	56	498,910	629,838			8 35	54,000					24,699		31
32	641	848		115	149		452	708		444,385	743,352			7 54		F 31	F 34	1,900		47,103		32
39	852	1,098		307	433					482,187	674,109			8 22		34	37	1,730	127,480	35,674	2 77	33
			48	39	57	5			55	67,076	118,300			1 21	20,511	D 26	D 26	2,120		3,720		34
	75	200	60	39	67	2	100	200	75	185,952	385,415	* 125,000	* 375,000	4 16	35,000	D 75	D 75	2,240	44,000	28,700	1 63	35
237	28	9		2	2					35,000	30,000	750,000	1,100,000	0 79	7,600	4	10	1,100	2,702	1,786	0 10	36
38	563	852		251	441		221	548		388,326	717,471			9 00		F 58	F 63	743				37
0	69	96	35	14	9	6	224	196	50	177,426	256,086	467,120	647,615	4 32	J 57,677	18	20	2,280	* 78,000	* 15,000	2 27	38
196										K 89,747	K 179,930			2 20	K 27,976	18	19	2,270		L 17,000		39
35	13	236		3	20		212	342		224,683	239,114			6 23	47,000	20	20	1,899	20,478	34,390	1 52	40
										96,786	114,063			2 66		8	8	4,520				41
	198	323		31	46		179	325		159,090	296,995			4 82		32	38	1,030				42
27	14	59		5	31					53,459	131,932	453,500	822,866	2 04	8,376	6	11	4,350				43
198	5			2			4									21	12	1,000	2,873	84,714	4 27	44
9	278	320		72	79					147,324	163,954			8 93		10	15	1,650	31,521	8,339	2 41	45
				35	48	12				42,192	70,300			3 01	8,000	5	5	2,800				46
20	55	118		17	55		4			79,591	110,386			5 84	12,542	13	14	1,050	26,793	6,113	2 41	47
73	963	1,301		105	123		233	229		913,908	1,225,326			14 90		55	57	1,110				48
0	198	405		50	50		385	987							81,759	25	25	1,440	81,357	11,233	2 56	49
	348	441	75	16	16	2	458	457	80	125,652	152,644	150,000	175,000	3 75	22,240	12	12	2,790	9,656	10,658	0 61	50
2	556	744	60	104	135	8	549	612	55	352,485	485,453	850,000	1,200,000	10 55	40,807	26	26	1,280				51
	30	16		6	4		12			33,073	44,581			1 14	4,850	4	5	725				52
0	13	0		2	0		0	0		24,203	100,424	140,000	382,000	0 63	3,100	I 9	I 9	7,500				53
11	59	75	80	14	26	1				100,468	142,793			3 80	46,748	8	8	3,400	18,350			54
6	187	272		63	67		186	161		139,948	149,571			4 20	28,503	12	13	3,750	78,433	48,209	3 80	55
	269	346	92	18	32	3	373	316	90	274,554	337,617			11 50		14	14	1,700	(M)			56
	264	279		123	188		205	424		514,115	872,052			5 27		102	146	960		L 52,750		57
0	651	1,072	60	221	418	6	711	1,080	60	1,320,194	2,078,349	1,000,000	1,250,000	15 30		190	178		(M)	78,230		58
7,173	333	56,372	Y66	8,905	14,268	Y6	34,037	48,953	Y67	34,811,866	51,941,323	22,466,834	26,857,643	Y4 52	2,414,347	4,140	4,596	Y3,241	4,407,855	3,016,848	Y2 06	Total
II—SOUTHEAST—South of Ohio River, East of Mississippi River																					
										1,418,077	1,948,144			9 42		56	56	3,000		167,000		60
179	854	1,871		6	6		449	436		1,793,958	3,287,207			10 65		150	195	1,053				61
198	0	0		149	377		803	933		K 236,088	K 257,193			1 74	K 70,440	40	36	3,380		L 35,000		62
551	972	953		0	0		0	0		900,048	1,861,346			7 28		F 82	F 115	1,500				63
78	96	77		141	91		930	317							K 40,000	32	39	3,960				64
				5	11		146	159														
898	595	991		70	145		259	139		638,622	1,534,663			5 52		F 57	F 69	2,030				65
2,197	107	84		19	22		150	64		264,896	248,070	7,418,527	5,116,782	2 62	48,179	62	61	1,620	174,130	203,645	3 75	66
0	871	1,160	73	196	254	3	353	520	62	511,824	922,760	1,680,000	3,000,000	5 92	91,635	97	101	890	136,881	45,151	2 11	67
7																3	3	28,000	6,500	10,000	0 20	68
68	293	431	53	53	97	2				474,475		*2,500,000		5 75	60,000	37	37	2,230				69
	68	53		10	9		97	33		308,841	315,539			8 63	93,721	25	25	1,435	102,484	* 50,000	4 27	70
24	66	212		15	24		18	86		259,209	538,222			7 80		F 11	F 13	3,020				71
15		43			6					35,067	161,776	* 375,000	* 500,000	1 14	1,246	3	10	10,200	* 7,500	* 1,000	0 28	72
4	0	0		0	0					K 40,348	K 57,473			1 44	10,660	9	9	3,100		L 6,300		73
54	106	209		15	31		138	152		151,248	334,710			6 94		F 15	F 19	1,450				74
5	0	0		0	0		0	0		K 31,516	K 71,783			1 58	K 7,684	6	6	3,320		L 6,100		75
37	17	18		0	0		7	2		48,475	135,946			2 84	5,353	4	8	4,250	12,622	4,156	0 98	76
61	87	161		10	29		65	79		114,764	246,604			8 32		F 10	F 12	1,380				77
403	18	9		2	0		21	5		53,097	50,523	198,411	438,506	3 89		13	13	1,050	36,631	6,000	3 12	78
	0	0		0	0		0	0		K 15,836	K 30,321			3 20	K 4,445	2	2	2,470		L 2,200		79

Excludes ades and

ting expense, including rural.

L Advertising only. M Appliance profit covers all costs. N Includes free wiring. O Includes commercial sales. P Decrease due to rate reduction
S Total domestic annual revenue increase. Y Straight-line average.

Domestic Appliance Sales and Promotion by Utilities

Table I— Total sales of household appliances by 129 power companies during the full year 1938, together with estimates of dealer sales of refrigerators, ranges and water heaters in the same areas.

Company	Domestic Consumers Dec. 31	Average Annual Domestic Kw.-Hr. Consumption		Av. Rev. per Consumer	Av. Price, Cents per Kw.-Hr.	REFRIGERATORS					RANGES					WATER HEATERS				
						Units Sold By Power Cos.		Units Sold By Dealers Pwr. Co. Est.		Saturation %	Units Sold By Power Cos.		Units Sold By Dealers Pwr. Co. Est.		Saturation %	Units Sold By Power Cos.		Units Sold By Dealers Pwr. Co. Est.		Saturation %
	1938	1938	1937	1938	1938	1938	1937	1938	1937	1938	1938	1937	1938	1937	1938	1938	1937	1938	1937	1938
80	[H] 39,929	830	847	42 83	5 20	219	401	3,729	4,656	50	96	191	405	330	5	39	89	100	71	
81	82,661	1,200	1,121	40 77	3 40	554	635	9,023	11,946	64	1,012	1,523	2,456	2,507	23	419	873	770	733	
82	[H] 43,530	830	773	38 07	4 58	83	141	5,114	7,464	50	19	19	81	40	1	2	1	11	2	
83	38,000	1,033	920	49 78	4 80		780	2,077	1,439	52	294	544	409	284	14	357	1,635	465	280	
84	[H] 37,280	771	742	41 03	5 32	219	401	3,729	4,656		96	191	405	330		39	89	100	71	
Total	1,651,218	[Y] 930	[Y] 930	[Y] 39 70	[Y] 4 12	16,363	35,687	78,352	108,288	[Y] 55	14,661	27,902	17,679	16,662	[Y] 15	6,797	15,596	6,253	5,936	
III—CENTRAL—West of Mississippi River, East of Rocky Mountains																				
87	[H] 323,819	1,014	909	35 56	3 51	3,662	3,560	18,000	20,000	45	2,961	4,552	2,965	4,127	13	1,971	2,703	1,645	1,946	
88	[H] 260,611	983	1,023	31 29	3 24	1,152	1,827	24,606	37,300	79	1,501	1,687	2,917	3,132	6					
89	126,094	930	884	38 42	4 13	1,350	1,740				1,174	891				175	71			
90	114,380	836	800	34 04	4 07	1,125	1,229	11,787	18,838	65	36	67	57	55	1	5	7	9	0	
92	103,004	652	624	35 70	5 47	898	3,808	10,828	11,350	37	291	659	311	153	6	35	88	38	67	
93	93,119	711	747	32 77	4 61						90	73	402	396		11	6	21		
94	[H] 90,226	588	552	33 81	5 75	746	1,287	3,943	4,793											
95	72,259	928	884	38 03	4 10	189	374	6,487	7,356	72	110	162	233	268	6	95	113	98	58	
96	72,000	908	860	36 72	4 04			7,593	9,797	58	2	2	43	41				4	6	
97	[H] 65,514	980	935	43 27	4 39	986	1,820	4,148	5,368	44	979	1,354	221	102	10	542	661	27	15	
98	59,424	801	752	40 50	5 00	1,430	1,355	4,923	5,618	55	493	698	56	94	5	190	297	4	6	
101	56,188	723	680	[P] 39 56	5 47	268	1,390	8,349	6,429	50	108	269	161	74	4	25	76	52	9	
102	56,000	676	628	36 64	5 54	835	1,065			27	526	754			12	474	611			
103	48,201	857	835	45 26	5 28	1,342	2,808	4,030	1,939	54	557	1,192	136	21	12	169	377	32	4	
104	40,165	863	814	35 40	4 10	223	357	1,621	1,749		443	576	377	271	16	161	274	71	30	
105	40,157	743	693	36 79	4 95	860	1,106	1,414	1,449	36	494	431	72	46	8	378	307	11	3	
106	37,393	946	898	45 21	4 78	1,542	1,737	1,547	1,494		672	595	44	14		383	471	12	1	
107	27,461	914	820	37 20	4 10	384	504	400	600	27	510	634	30	50	22	259	325	5	5	
108	24,164	809	765	40 34	4 98	306	396	1,248	1,539	47	289	455	141	151	20	101	152	26	13	
109	24,000	569	530	32 97	5 79	812	1,007				103	142				68	34			
110	23,368	736	702	37 46	5 08	289	819	1,541	2,005	48	258	582	91	65	8	32	58	9	7	
111	21,070	716	683	37 52	5 10	409	976	378	332	43	277	421	32	4	14	36	23	2		
112	20,442	1,081	1,006	40 33	3 81	395	653	1,066	1,605	58	293	456	34	10	18	300	275	13	11	
113	19,587	809	777	36 21	4 46	830	1,202				225	204				17	11			
114	[H] 18,812	753	719	33 60	4 46	13	15	1,904	2,421	37	3	0	0	0	0	0	0	2	2	
115	16,969	617	589	34 58	5 60	156	231	804	1,097		143	180	32	32	11	26	32	3	8	
116	15,338	585	568	34 47	5 90	273	309	436	472	38	144	150	47	22	10	43	45	6	8	
117	10,042	778	705	40 28	5 18	83	202	490	753	55	137	213	74	54	15	67	163	24	21	
118	6,485	640	672	33 43	5 20	199	134	225	120	28	9	6	10		3	3				
119	3,851	949	877	40 92	4 45	36	60				117	91				40	25			
To'al	1,919,322	[Y] 791	[Y] 757	[Y] 37 20	[Y] 4 77	21,055	32,495	121,369	147,057	[Y] 47	12,974	17,562	8,664	9,331	[Y] 9	5,643	7,264	2,176	2,271	
IV—WESTERN—Rocky Mountains to Pacific Coast																				
122	530,509	897	849	31 39	3 49	0	0	40,064	49,083	43	1,322	1,584	2,747	2,740	9	1,217	1,136	1,148	1,402	
123	448,931	946	910	34 95	3 69	0	0	33,052	49,396	60	1,309	705	3,811	6,600	10	405	626	1,125	2,037	
124	166,869	1,256	1,202	34 90	2 78	394	1,192	8,396	10,062	30	1,597	2,891	1,751	1,335	26	895	1,635	690	583	
125	115,939	1,317	1,237	35 42	2 69	285	730	6,000	7,000	46	678	1,393	3,462	2,425	25	647	1,496	675	30	
126	110,895	643	611	35 65	5 50	1,211	1,847			48	398	772			1	30	85			
127	100,879	1,044	958	37 96	3 66	642	1,360	6,830	9,440	55	1,080	2,310	1,862	2,417	35	516	1,268	299	368	
128	72,861	900	835	32 62	3 60	273	440	7,402	8,185	62	281	472	307	328	7	326	455	249	178	
129	66,375	1,985	1,879	44 10	2 22	118	248	6,390	7,549	45	721	1,043	1,535	1,112	33	826	1,369	765	468	
130	50,025	1,719	1,577	46 43	2 79	585	677	3,520	4,941	45	1,748	2,011	2,727	2,552	53	1,485	1,756	618	532	
131	39,562	1,354	1,308	34 25	2 53	14	21	3,264	3,178	51	33	42	1,572	1,532	40	112	143	305	211	
132	23,591	975	919			25	30	2,382	3,315		28	21	234	285		6	4	59	124	
133	22,594	815	741	39 82	4 99	327	371	1,382	1,916	32	296	329	84	49	20	150	158	23	10	
134	12,892	911	876	42 19	4 63			1,200	1,118	65			150	145	10			60	54	
135	3,655	1,094	999	35 04	3 30	2	9				51	88	26	18		38	24	1	0	
136	54,081	1,550	1,475	40 99	2 65	457	751	4,855	6,038	36	890	998	803	680	18	472	836	578	230	
137	23,885	2,167	2,100	48 08	2 22	572	923	2,000		19	1,185	1,982	502		46	775	886	205		
138	11,131	1,440	1,354	52 39	3 64			971	1,250	66			713	904	53	3	4	232	277	
Total	1,904,674	[Y] 1,235	[Y] 1,165	[Y] 39 20	[Y] 3 40	4,905	8,599	127,708	162,471	[Y] 47	11,617	16,641	22,286	23,122	[Y] 26	7,903	11,881	7,032	6,504	

[C] Estimated. [A] Outside salesmen only. [B] All lamps. [C] At net prices. [D] District representative plan. [E] Ranges and water heaters only. [F] Excludes
lighting specialists. [G] Rental purchase plan. [H] Company has gas customers. [I] Combined with gas expense. [J] Includes dealers' sales. [K] Includes gas

Table II—Regional Summary and Comparison

Some general reflections of local conditions and the sales activity of the power companies in the four major areas of the country.

Region	Total Domestic Consumers Dec. 31, 1938	Av. Dom. Kw.-Hr. Consumption 1938	Kw.-Hr. Increase Over Dec. 31, 1937	Av. Cost of Dom. Service Cents per Kw.-Hr. 1938	Av. Revenue per Consumer 1938	Refrigerators Units Sold by Power Cos. 1938	Ranges Units Sold by Power Cos. 1938	Water Heaters Units Sold by Power Cos. 1938	Washing Machines Units Sold by Power Cos. 1938	Ironing Machines Units Sold by Power Cos. 1938	Vacuum Cleaners Units Sold by Power Cos. 1938	Refrigerators Sold per 1,000 Consumers 1938	Ranges Sold per 1,000 Consumers 1938	Water Heaters Sold per 1,000 Consumers 1938	Washing Machines Sold per 1,000 Consumers 1938
Northeast	8,564,412	803	52	4.50	36.20	66,928	46,956	15,361	38,333	8,905	34,037	8	5	2	
Southeast	1,651,218	990	60	4.12	39.70	16,363	14,661	6,797	4,290	728	3,802	10	9	4	
Central	1,919,322	791	34	4.77	37.20	21,055	12,974	5,643	6,219	951	5,244	3	7	3	
Western	1,904,674	1,235	70	3.40	39.20	4,905	11,617	7,903	2,483	649	1,989	3	6	4	
Nat'l Total or Average	14,039,626	903	53	4.30	38.80	109,251	86,208	35,704	51,325	11,233	45,072	8	6	3	

nd their Local Dealers for the Full Year 1938

Also, comparisons of these sales totals with the year 1937, with data on average consumption, rates, revenues, saturations, sales totals, sales people and direct sales and promotional expense in building domestic load — embracing over fourteen million consumers.

Washing Machines Units Sold By Power Cos.		Saturation Washing Machines, %	Ironing Machines Units Sold By Power Cos.		Saturation Ironing Machines, %	Vacuum Cleaners Units Sold By Power Cos.		Saturation Vacuum Cleaners, %	Total Sales of All Appliances By Power Cos. (Dollars)		Total Sales of All Appliances By Dealers (Dollars)		Power Co. Sales Per Consumer ($)	Annual Rev. Inc. from Power Co. Sales (Dollars)	No. Power Co. Salesmen and Women Building Domestic Load		Consumers Per Sales Person	Power Co. Direct Sales Expense ($)	Power Co. Advtg. & Promotion Exp. ($)	Sales & Adv. Exp. Per Consumer ($)	Company
1938	1937	1938	1938	1937	1938	1938	1937	1938	1938	1937	1938	1937	1938	1938	1938	1937	1938	1938	1938	1938	
66	134	5	29	37	1	156	168		144,661	198,258	1,895,006	1,870,185	3 62	37,983	55	49	725	124,630	169,053	7 34	80
2	20					33	28		550,371	778,617	3,899,586	4,485,738	6 75	76,811	55	64	1,500	167,000	68,900	2 85	81
26	39	25	8	1	5	21	52	45	76,141	137,529	2,721,305	2,775,120	1 75	21,953	51	57	850	14,976	127,940	3 77	82
									158,000	315,950	850,000	1,250,000	4 15	136,619	12	12	3 160	59,571	47,751	2 80	83
66	134					156	168		146,761	198,251	1,748,245	1,671,934	3 94	37,169	43	37	870		170,690	4 57	84
6,280	6,599	Y39	728	1,140	Y3	3,802	3,341	Y54	8,372,323	13,630,885	23,286,080	21,108,265	Y5 00	743,898	930	1,048	Y3,460	842,925	1,120,886	Y3 00	Total
III—CENTRAL—West of Mississippi River, East of Rocky Mountains																					
616	652	75	235	243	13	1,496	1,673	72	1,585,000	1,740,000	6,400,000	6,700,000	4 90	267,000	200	215	1,620	400,000	215,000	1 87	87
															140	130					88
917	1,119		65	137		398	482		986,090	1,089,980			7 80	145,473	130	120	970				89
27	32	30	1	5	4	767	532	30	481,593	495,939	5,368,701	5,884,995	4 20	62,055	72	70	1,610				90
194	1,399					79	219		410,607	1,341,664	3,250,410	3,958,146	3 98	69,226	91	128	1,030	71,990	236,069	2 99	92
									17,741	14,558			0 19		17	15	5,470	44,191	25,011	0 75	93
623	634		26	48		264	369		408,102	442,967	2,701,000	2,743,629	4 54	140,710	64	56	1,410				94
113	218		53	77		162	484		201,000	306,000	3,170,000	3,315,000	2 77	19,600	58	54	1,245				95
						139	81		125,703	146,107			1 74	27,355	67	30	1,075		154,495	2 16	96
56	102		1	4		68	92		421,273	620,477			6 42	81,552	D 75	D 60	875	200,133	50,013	3 82	97
682	983	26	76	125	1	180	252	65	515,871	552,255	2,000,000	2,000,000	8 70	46,024	39	41	1,520	98,646	150,499	4 20	98
90	177	23	5	15	1	75	102	26	187,834	541,047	2,926,336	2,574,260	3 34	28,475	46	44	1,220	6,185	135,864	2 53	101
208	116		41	32					377,948	447,018			6 70	113,291	32	21	1,750	63,033	39,000	1 82	102
488	824		97	171		169	237		700,139	914,356			1 45	55,641	71	85	678	276,477	94,477	7 67	103
231	324		51	129		209	403		197,146	265,425			4 90	44,188	40	45	1,000	49,946	159,920	5 23	104
182	220	70	46	29	1	296	449	69	333,200	441,138	323,600	373,500	8 27	52,914	44	44	912		20,000		105
407	610		56	69		189	235		844,080	848,777			22 60	208,835	46	48	813				106
28	87		6	12		6	27		143,000	159,000			5 23	36,000	9	10	3,050	38,024	1,595	1 44	107
140	107	85	22	45	2	101	166	85	144,400	193,680			5 97	16,168	28	35	863	28,324	42,209	2 92	108
229	290		22	14		136	152		345,083	376,998			14 30	71,937	23	21	1,050	64,669	29,529	3 90	109
128	247	77	35	59	3	42	83		159,175	255,383			6 80	49,723	21	33	1,110	67,402	7,776	3 22	110
135	300		20	20		134	225		179,189	317,656			8 50	35,752				83,828	9,408	4 42	111
66	132		28	47		61	22		228,618	277,446			11 15		13	13	1,570	21,500	19,400	2 00	112
170	145		14	27		55	196		309,504	378,217			7 00	37,718	28	18	700	37,521	50,451	4 50	113
8	8		1	2		14	31		28,708	22,865			1 52		3	3	6,270	20,316	9,952	1 61	114
83	164		24	34		23	65		110,493	127,863			6 50	8,280	10	11	1,700	38,305	33,828	4 25	115
171	179		24			65	66		108,600	127,000			7 10	14,827	7	8	2,191	15,700	12,065	1 81	116
12	41		3	3					77,580	110,000			7 70	7,981	8	11	1,255	18,385	1,650	1 99	117
75	73	75	4	8	9	97	101	62	84,010	64,959	93,000	60,000	12 98		10	7	649	15,553	5,256	3 20	118
									41,000	41,700			10 65		3	3	1,280	14,980		3 96	119
9,219	9,743	Y53	951	1,379	Y4	5,244	6,787	Y58	9,877,804	12,858,511	27,383,207	28,420,102	Y6 71	1,666,225	1,430	1,411	1,580	1,665,108	1,665,028	Y3 24	Total
IV—WESTERN—Rocky Mountains to Pacific Coast																					
0	0	60	0	0	10	0	0	58	616,614	468,061	24,500	28,801	1 06	193,265	210	210	2,760	250,000	325,000	0 99	122
0	0		0	0					741,904	766,081	12,000,000	16,000,000	1 65	1,472,449	112	117	4,000				123
									676,862	1,195,193	2,178,138	2,325,000	4 00	83,900	59	73	2,830				124
130	247	58	58	84	17	71	127	62	305,000	614,000	2,000,000	2,100,000	2 63	52,000	44	75	2,630	138,000	117,000	2 20	125
366	1,038	57	110	236	6	1,153	1,475	63	783,715	1,031,128			7 05		81	94	1,370		129,946		126
212	337	77	64	115	1	219	312	78	522,078	874,963	4,610,616	5,522,737	5 47	57,181	87	102	1,160				127
191	228		67	82		186	171		227,631	295,995	2,657,402	2,879,839	3 12	65,126	30	30	2,430	111,634	47,316	2 17	128
116	213	75	42	79	10	8	28	85	298,411	433,415	2,995,855	3,229,970	4 50	48,113	56	60	1,185	223,192	79,139	4 55	129
357	422	85	144	140	10	136	150	70	553,258	644,208	2,102,064	2,425,868	11 00	98,832	56	55	895	53,000	126,000	3 60	130
22	20	66			9	13	10	66	27,569	37,548	2,210,000	2,209,000	0 70	5,757	12	12	3,290		128,334	3 24	131
4	10					4	5		22,179	33,142	1,137,793	1,432,079	0 94	8,066	25	24	943				132
72	110	75	27	27	2	100	135		162,505	191,128			7 20		13	14	1,740				133
									5,000	12,000	300,000	300,000	0 39	1,250	4	6	3,220	2,213	15,252	1 35	134
1	3		1	0		1	0		14,634	16,465			4 00		2	2	1,830				135
387	925	78	136	316	6	98	130		301,830	438,482	2,161,399	2,404,126	5 60	53,218	32	35	1,690		42,021	7 75	136
									297,911	520,485	313,400		12 50	84,000	25	32	955				137
											675,000	1,000,000		500	2	2	7,430	2,000	33,941	3 22	138
2,483	3,553	Y 70	649	1,079	Y 8	1,989	2,543	Y 69	5,557,101	7,572,294	35,366,167	41,857,420	Y 4 48	2,223,657	850	943	Y2,380	780,039	1,043,949	Y3 23	Total

ludes h... gas w... — ...rating expense. L Advertising only. M Appliance profit covers all costs. N Includes free wiring. O Includes commercial sales. P Decrease due to rate reduction.
...including rural. S Total domestic annual revenue increase. Y Straight-line average.

on ...Sales Totals, Saturations and Averages

Relating roughly the prevailing cost of using appliances, their present popularity and the scale on which they are being sold

...try.	Washing Machines Sold per 1,000 Consumers 1938	Ironing Machines Sold per 1,000 Consumers 1938	Vacuum Cleaners Sold per 1,000 Consumers 1938	Average Saturation Refrigerators 1938 %	Average Saturation Ranges 1938 %	Average Saturation Water Heaters 1938 %	Average Saturation Washing Machines 1938 %	Average Saturation Ironing Machines 1938 %	Average Saturation Vacuum Cleaners 1938 %	Total Appliance Sales by Power Cos. (Dollars) 1938	Appliance Sales per Consumer (Dollars) 1938	Total Annual Revenue Increase from Power Co. Sales 1938	Total Sales People on Domestic Load 1938	Consumers per Sales Person 1938	Power Co. Direct Sales Expense 1938	Power Co. Adv. & Promotion Expense 1938	Sales & Adv. Exp. per Consumer	Region
	1	4	44	11	2	66	6	67	34,811,866	4.52	2,414,347	4,140	3,241	4,407,855	3,016,848	2.06	Northeast
	1	2	55	15	6	39	3	54	8,372,323	5.00	743,898	930	3,460	842,925	1,120,886	3.00	Southeast
	1	2	47	9	3	53	4	58	9,877,804	6.71	1,666,225	1,430	1,580	1,665,108	1,665,028	3.24	Central
	1	1	47	26	11	70	8	69	5,557,101	4.48	2,223,657	850	2,380	780,039	1,043,949	3.23	Western
	1	3	48	15	4	64	6	65	58,619,094	5.20	7,048,127	7,350	2,780	7,695,927	6,846,711	2.80	Nat'l Total or Average

ing job with dealers paid $1.05 in 1938 for a dollar of new revenue and the "non-merchandising" group added a dollar of new revenue for $1.10. As recently as two or three years ago it was considered customary to pay 75-80 cents for a dollar of residential revenue, so again we have evidence of the extra expenses incurred by utility companies during the past year to add residential load and revenue.

Continuing, it should be noted (2) that utilities are accomplishing highly laudable results from their selective load building, including the cultivation of the low-use customer who buys kilowatt-hours in the higher brackets. The companies which are staying in the merchandising business and thus are better able to direct sales efforts won 1.35 cents from each *new* kilowatt-hour sold in 1938. When the other group of companies are added to the picture, the industry is found to have secured 1.45 cents for each *new* kilowatt-hour sold in 1938. Both figures are a safe distance away from the 9 mills reported in ELECTRICAL WORLD for the first time in the 1937 Statistical Issue.

Finally, it will be seen that the group of "non-merchandising" companies is reduced this year. Three new companies, with 355,424 domestic meters, joined the roster. But it developed that, on the other hand, eight companies serving 755,176 domestic meters were found to be actively merchandising even though they were generally thought to have been on a non-merchandising basis.

Companies in Table I

From this point on the discussion concerns the 129 utility companies serving more than fourteen million residential and farm customers, the result of which operations are given in Table I.

They themselves directly sell and promote electric appliances and the dealers in the respective territories of these 129 utilities also sell and promote.

During 1938 these companies sold $58,619,094 of appliances and their dealers' sales totaled $108,502,288 Sales of utility companies dropped $27,000,000, or 31.8 per cent, below the 1937 volume. Dealers' sales were off only $9,700,000, or 8.2 per cent, below their 1937 volume.

The combined volume of dealers' and utilities' sales was off $37,000,000, or 18 per cent, from the 1937 volume. Merchandise sales per customer of $11.92 were about 22.8 per cent below 1937 sales. Sales per customer in the "non-merchandising" companies were 20.9 per cent below those for 1937.

To attain sales per customer of $11.92 these utility companies alone employed 7,350 men and women on direct residential load building and in addition spent more than $14,500,000, or approximately $2.88 per domestic customer. Fifty-three per cent of the expenditures were charged to direct sales expense, 47 per cent to promotion (and advertising) expense. There is no record of what dealers spent to move the 1938 volume of $108,000,000 attributed to them by their utility companies.

Table III
Distribution of Unit Sales of Important Appliances

Proportion of appliances sold by utility companies and by local dealers as reported by utility source. This table is computed for those companies which divide the merchandising job with their dealers.

Appliance	Company Sales, Per Cent	Dealer Sales, Per Cent
Refrigerator	**11**	**89**
Range	**45**	**55**
Water Heater	**61**	**39**
Washer	**9**	**91**
Ironer	**15**	**85**
Vacuum Cleaner	**10**	**90**

This table is based upon reports from the 129 companies listed in Table I, but to provide greater accuracy, those companies were rejected from the computation which did not report *both* dealer and company sales.

For example, the Northeast companies reported in Table I show company refrigerator sales of 66,928 and dealer refrigerator sales totaling 218,415. However, a selection of companies, as explained above, results in more accurate basic data for this computation of 31,365 units for company sales and 163,460 dealer sales. This "net" method was used for all calculations this year in this table.

Benefits to utilities

As a result of the combined efforts of utilities and dealers coupled with the cumulative effects of previous years' efforts the average usage was raised from 901 kw.-hr. to 955 kw.-hr., a gain of 54 kw.-hr.

The average bill was raised from $37.35 to $38.08, a gain of 73 cents. These 129 companies therefore took on their added kilowatt-hours in 1938 at a price of 1.35 cents.

The important question here is, specifically, just what did all these sales efforts mean to the utility company, translated into figures showing exact revenue gains and what it cost to secure the revenue.

To reach the answers to these questions, 66 companies have been selected from Table I and part of the data from these companies are reproduced below.

These 66 companies, with 5,490,822 customers, derived $3,510,387 of E.A.R. from their own sales to customers and $11,500,243 of E.A.R. from appliances sold to their customers by the dealers. Total E.A.R. per customer amounted to $2.74, of which $2.10, or 76 per cent, came from dealers' sales. These sales for 129 companies, it will be recalled, were $108,500,000, or 66 per cent of all sales that were reported by the companies.

These companies spent $2.88 per customer per year last year for sales and promotion, or $1.05 to get one dollar of E.A.R. As previously stated, the second group of companies, listed in Table IV, and selling through dealers exclusively, spent $1.10 to get one dollar of E.A.R.

While this is as close as the utility industry can expect to get at this time to the dollar and cents comparison of the two methods of load building, a further word seems advisable. It should always be recalled that a load-building program is

E.A.R. per Customer for 129 Utilities

Group	No. of Cos.	No. of Customers	From Company Mdse. Total	From Company E.A.R. per Customer	From Dealer Mdse. Total	From Dealer E.A.R. per Customer	Total E.A.R. per Customer
Northeast	24	2,251,840	$1,301,696	$0.58	$3,248,956	$1.44	$2.02
Southeast	13	772,924	541,926	0.70	2,417,426	3.12	3.82
Central	18	1,182,475	1,000,057	0.85	2,913,521	2.46	3.30
West	11	1,283,583	666,708	0.52	2,920,340	2.28	2.80
Total	66	5,490,822	$3,510,387	Z0.64	$11,500,243	Z2.10	$2.74

Z means weighted average.

tailor-made for the specific company involved. This is because from time to time the problems faced by a utility vary and the load-building program adopted is of a form to assist in the solution of those pending problems.

Accordingly it is very improbable that a difference of 5 cents per dollar in the cost of securing one dollar of revenue would carry much weight if legislative matters, public relations, drastic rate reductions, government competition or any one of a host of other factors entered the general management picture. A load-building program should be a means to an end, not an end in itself.

Utilities Promoting Through Dealers

Eight companies leave "non-merchandising" classification — Dealer sales volume drops 17.6 per cent, but lighting sales up 10.6 per cent — New data on cost to build load shows $1.10 per dollar of estimated annual revenue

We now turn our attention to the second group of companies comprising those utilities which accomplish their residential load-building objectives through appliance and lighting sales made by the dealers in the respective service territories. These companies sell no appliances or lighting devices, but do provide money and personnel to guide and stimulate and assist in dealers' sales.

This year the tabulation (See Table IV) carries data from eight companies which were members of this group last year. These eight companies have 535,911 residential customers.

However, a second group of companies, likewise eight in number, and with 755,176 customers, or 41 per cent more than in the first group, have been transferred to and this year are reported in the group shown in Table I.

A new form of questionnaire, used for the first time this year, revealed that these eight companies heretofore considered as "non-merchandising" were in fact selling appliances themselves as well as selling through dealers, and a large proportion of them selling on a very substantial scale.

It cannot be assumed that all of these companies changed their status during 1938, but correction of their classification should be reflected in better comparisons of results of the two general load-building policies.

Three more companies, with 355,424 residential meters, were added to the tabulation this year as they changed their operating policy from sales and promotion to promotion only of residential business and actual sales are made by their dealers. One of these utilities is on the Atlantic seaboard, a second is on the Pacific Coast and the third is in the central zone.

One company shown last year did not report this year, so our group now consists of eleven companies located in ten states and serving 891,335 domestic meters.

The companies are straight electric or combination gas and electric with the latter comprising 223,150 meters, or 25 per cent of the total. In last year's summary 36 per cent of the meters were in combination companies, and thus residential gas and residential electric load-building policies were in all probability complementary.

Market results

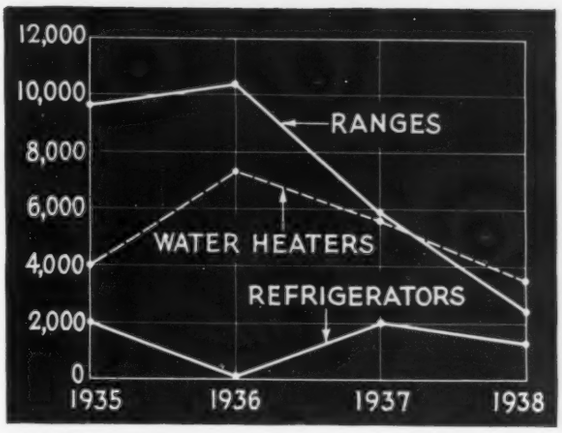
The "market" represented by customers of these eleven companies increased numerically by 4.32 per cent in 1938, to 891,335.

The merchandise sales volume by dealers in the territories of these utilities amounted to $19,244,243, a drop of 17.6 per cent from the $23,347,537 of merchandise they sold in 1937. This decrease is much less than that shown by combined utility-and-dealer sales in the preceding group of 129 utilities, but twice as large as was shown by solely dealer sales.

Reduced to a per-customer basis, sales of $21.60 in 1938 compare with sales of $27.30 the year before, a drop of 20.9 per cent.

Changes in sales pace

At this point it is of interest to note that according to data reported, but lacking room for publication, the dealers sold 82,499 refrigerators in 1937 compared to 62,752 (after adjustment for one company) in 1938, a decrease in 1938 of 24 per cent and saturation in these company areas is now reported to be 60 per cent.



RENTALS DIMINISHING—Apparently the industry is finding a satisfactory substitute for long-term rentals. Details on next page.

Similarly, dealers' range sales for 1937 were 11,354, a decline during 1938 of 20.9 per cent. Water heater sales in 1937 totaled 2,292 and thus were off only 9.25 per cent in 1938. Saturations at the end of 1938 for ranges and water heaters were respectively 13 per cent and 6 per cent.

In these calculations a word of caution is necessary due to the effect of one company—a star performer in 1937, with its sales per customer of $100, and this year reporting $60, or almost three times as great as the average for the group of companies. If this company were not included, saturations at the end of 1938, for example, for refrigerators would appear as 59 per cent instead of 60 per cent; range saturation as 7 per cent instead of 13 per cent and water heater saturation as 4 per cent instead of 6 per cent.

An inspection of the reports shows that companies reporting dealers' sales of washers, ironers, vacuum cleaners and other appliances experienced comparable losses in these items with the notable exception of I.E.S. lamps.

Dealer lamp sales increase

Seven companies reporting dealer sales of I.E.S. lamps showed sales of 45,880, an *increase* over 1937 sales of 4,400, or 10.6 per cent. One of these seven companies volunteered the information that dealers sold 1,864 roasters in 1938, exactly four times the volume in the previous year.

Thus it is manifest that under

Table IV—Load Building Where Utility Sells Through Dealers

Consumption, growth of load, average rates, revenue and number of salespeople and advertising and promotion expense per consumer, together with power company estimates of dealer sales and saturations of the major appliances

Company	Total Domestic Consumers		Av. Annual Domestic Consumption		Av. Annual Domestic Revenue		Av. Price Dom. Service — Cents	Refrigerators Units Sold by Dealers	Saturation of Refrigerators	Ranges Sold by Dealers	Saturation of Ranges Per Cent	Water Heaters Sold by Dealers	Saturation Water Heaters Per Cent	Number Power Company Sales Men and Women Building Dom. Load		Advertising and Promotion Expense (Dollars)	Adv. and Prom. Exp. per Consumer ($)
	1938	1937	1938	1937	1938	1937	1938	1938	1938	1938	1938	1938	1938	1938	1937	1938	1938
139	188,441	176,773	911	881	35.19	34.96	3.86	11,483	47	2,085	6	233	1	.....	135	395,000	2.09
140	164,383	159,553	1,143	1,104	31.44	32.69	2.75	15,772	.....	2,110	.....	247	.....	32	26	.....	.....
141	104,961	101,531	748	725	37.15	3.455	4.97	11,796	65	139	2	0	.....	25	15	150,000	1.43
142	90,365	85,841	1,255	1,187	41.49	40.00	3.31	6,852	55	1,447	15	727	6	34	36	235,971	2.61
143	76,618	71,148	954	934	42.56	43.48	4.46	6,666	63	1,015	16	352	3	.....	.....	.....	.....
144	63,445	61,741	934	869	43.88	42.00	4.70	4,706	.....	659	.....	646	.....	22	22	226,641	3.56
145	62,831	62,733	1,246	1,192	42.47	42.04	3.39	3,819	65	1,192	18	283	5	21	23	206,000	3.28
146	58,209	56,222	681	628	27.46	25.66	4.03	5,738	51	126	1	23	.....	24	24	.....	.....
147	57,453	55,262	817	768	41.49	39.83	5.08	5,332	58	381	2	16	.....	.....	.....	117,461	2.06
148	13,498	12,998	.....	.....	35.33	35.39	4.90	1,100	70	50	1	0	0	1	1	32,000	2.37
Total..	880,204	843,802	[Y]1,043	[Y]921	[Y]37.85	[Y]37.25	[Y]4.14	73,264	[Y]59	9,204	[Y]7	2,527	[Y]4	159	282	1,363,073	[Y]2.48

[Y] Straight-line average.

utility guidance in a poor year, when major appliance sales are off, dealers can and will sell more lighting—the "universal load builder"—and other devices used for building consumption.

Appliances vs. revenue

Utility management is interested in sales of appliances as such because only by lighting and merchandise sales can customers' loads, usage and revenues be increased or, in fact, retained against load mortality.

The questions management asks concern the average bill per residential customer, the killowatt-hours purchased compared to previous periods, the new revenue actually passing through meters and paid for, and in the larger and more important operations what did it cost the company to get the new business.

We can proceed to a determination of these answers for this group of companies to present again this year those results which appear nowhere else in print and are after all the final answer for management to the question: "Are we ready yet to transfer load building to our dealers?"

It is probably noteworthy that this year 60 per cent of the companies, in terms of residential meters, presented the complete data necessary for the analyses underlying these published results.

Therefore a tabulation is prepared embracing these companies and the diversity in size, geographical location and character of operation makes these companies truly typical for our purposes.

What did these companies get from their dealer sales plans?

First of all, average usage increased 47 kw.-hr. to 1,092 in 1938. The average bill went from $41.14 to $41.87 in 1938, an increase of 73 cents. The average rate at which all domestic service was sold in 1938 was 3.94 cents and the kilowatt-hours *added* in 1938 were bought for the very commendable price of 1.55 cents each. The increment rate, first described in ELECTRICAL WORLD in January, 1937, as the price of newly added kilowatt-hours was then only 9 mills.

To gain these results these companies increased their own sales forces to 217 in 1938, and for promotion and advertising of residential load spent $1,216,755, or $2.53 per customer.

Results of dealer sales

With this expenditure, they saw dealers sell $16,028,596 of appliances which brought in $1,236,772 of estimated annual revenue. Reduced to a per-customer basis, the dealers sold $30.01 of appliances per customer, which brought in an E.A.R. of $2.31 per customer.

To get $2.31 of E.A.R. the utilities spent $2.53 and their residential load building cost in 1938 was accordingly $1.10. This means that it cost these companies which sold exclusively through their dealers $1.10 to get one dollar of new residential revenue onto their lines.

As information for further analysis it might be added that comparable figures reported by the same companies for their 1937 results are as follows: Dealers' sales, $19,693,079; E.A.R. from dealers' sales, $1,374,509. As there were 508,616 customers served by these companies in 1937, sales per customer were $38.86, or $8.87 above the 1938 sales, and E.A.R. per customer was $2.70, or 39 cents above 1938 E.A.R.

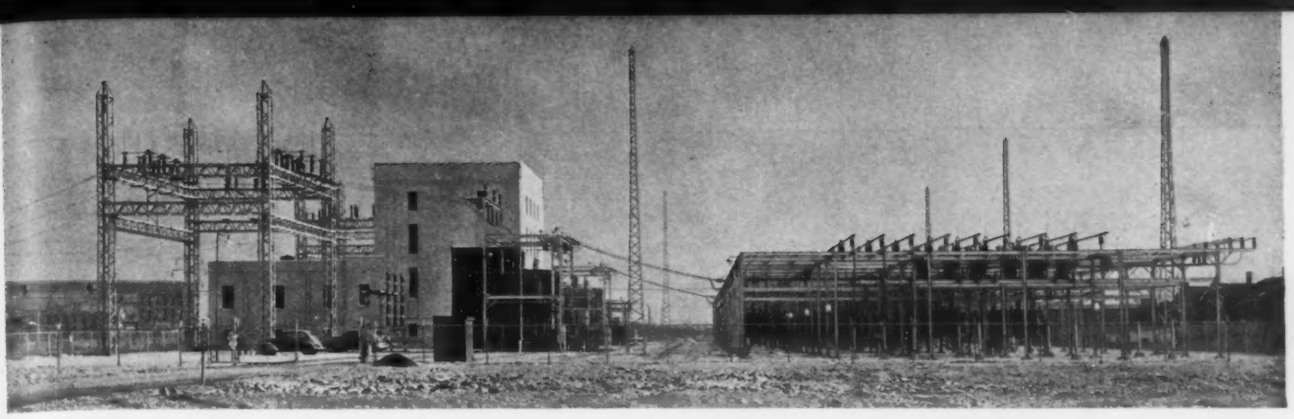
Table V
Trends in Renting Appliances

Rentals of major appliances as reported for 1938 and 1937. Companies not included in this table reported no rentals.

Company	Water Heaters 1938	Water Heaters 1937	Ranges 1938	Ranges 1937	Refrigerators 1938	Refrigerators 1937
3.....	2,562	4,732	1,529	3,069	....	....
11.....	....	....	2	817	....	....
12.....	433	65	....	....	....	....
16.....	108	121	316	529	....	....
17.....	65	92	....	....	....	....
22.....	103	150	364	1,016	....	....
40.....	0	21	0	56	....	....
61.....	....	....	....	....	865	1,977
63.....	61	87	79	78	....	....
64.....	0	37	....	....	....	....
70.....	0	38	0	92	....	....
89.....	100	122	0	20	....	....
105.....	7	105	0	31	0	1
107.....	97	80	188	201	....	....
111.....	....	....	0	10	0	24
Totals...	3,536	5,650	2,478	5,919	865	2,002

Rentals by One Company That Only Promotes Sales

Company	Water Heaters 1938	Water Heaters 1937	Ranges 1938	Ranges 1937	Refrigerators 1938	Refrigerators 1937
145.....	225	340	0	667	....	....
Grand total...	3,761	5,990	2,478	6,586	865	2,002



New Station Strengthens Buffalo System

By R. T. HENRY

*Electrical Engineer in Charge of Design, Buffalo Niagara Electric Corporation**

SENECA terminal station represents a major step in the development of the electric distribution system in Buffalo. It provides a reliable supply to the southeast section and emergency supply to the rest of the city. The design of the station is very simple yet very flexible. Bus sections are small, to limit the extent of trouble. Complete relaying is provided to isolate faults quickly and back-up relays protect against failure of breakers or relays. Oil-filled equipment is located outdoors, well spaced and provided with adequate oil drainage to minimize the danger of serious fire, and adequate fire-fighting equipment is provided to extinguish fire. The station has been in service since the first week of December, 1938.

When the new 60-cycle distribution system was built in Buffalo, during 1930 and 1931, the supply to the entire system was provided by 22-kv. underground cables from the C. R. Huntley station, which lies in the extreme northwest corner of the area.

These cables were routed to the various substations with a view to the installation at some future time of a major supply station in the southeast section of the city, when the growth of the load would warrant such a step.

When it became apparent that by the fall of 1938 it would be necessary to provide additional 22-kv. cable capacity to supply the increasing loads in the various substations and networks two schemes were considered. One scheme contemplated installing additional 22-kv. cables from the C. R. Huntley station. The other carried out the idea of a new major supply station in the southeast section of the city which would provide the additional capacity required immediately and would also provide a comfortable margin of capacity for further growth of the load. In addition, it would provide an emergency supply entirely independent of the C. R. Huntley station. It was therefore decided to build the Seneca terminal station in 1938.

Fig. 1—At opposite system corners

Map of the Buffalo system showing the routes of the 22-kv. cables, the location of the substations and the two low-voltage networks. Each heavy line represents a group of three or more 22-kv. cables, as supplied from the C. R. Huntley station before the Seneca terminal station was built. The dotted lines show how the cables were extended to the new station. Twelve substations and the Broadway network were transferred from the C. R. Huntley station to the Seneca station by cutting the 22-kv. cables at points "A," "B," "C" and "D."

The location of the new station in relation to the system appears in Fig. 1. Emergency tie switches are provided at the three points "A," "B," and "C" shown in the figure. These are oil circuit breakers which can be used to connect each of the nine cables which normally supply the network from C. R. Huntley station to corresponding cables from the Seneca station.

These nine emergency tie breakers can be closed simultaneously from a central point, making it possible to pick up the downtown network from Seneca in case of a total failure at the generating station. The substations which

*Adapted from paper to E.E.I. electrical equipment committee at Buffalo, N. Y., February 6, 1939.

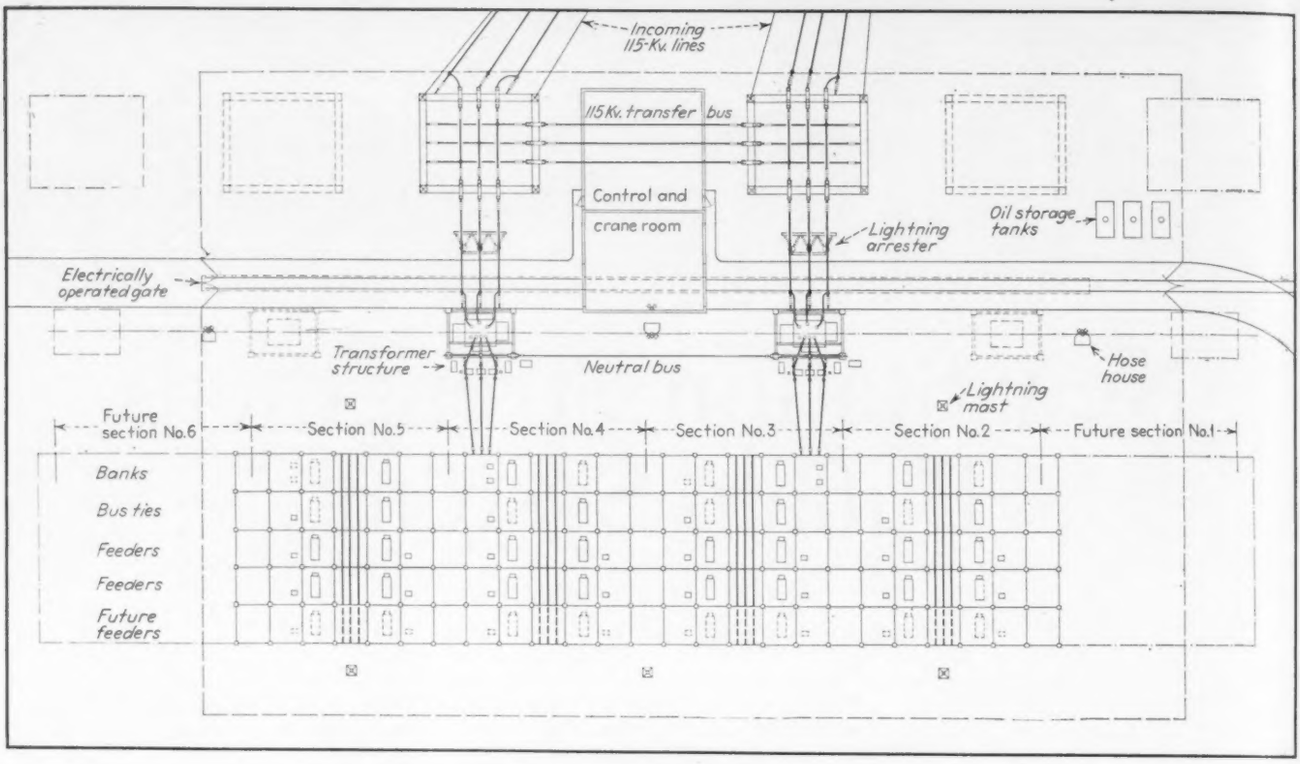


Fig. 2—Plan shows arrangement of Seneca station

are supplied from the nine network cables can be picked up along with the network.

Emergency switching stations are being installed at points "D," "E" and "F" (see Fig. 1). These emergency switching stations will be equipped with disconnecting switches and can be used to disconnect the sections of cables between the C. R. Huntley station and points "E" and "F" in case of serious trouble in these sections, or at the C. R. Huntley station, or to make emergency connections from each cable in any group to corresponding cables in either of the other groups in case of trouble or more than one cable in any group. They can also be used for emergency supply from the Seneca station to the twelve cables normally supplied from Huntley.

By means of the oil circuit breakers at points "A," "B" and "C" and the disconnecting switches at points "D," "E" and "F" it would be possible to energize all of the substations and both the networks from the Seneca station in case of a total failure at the C. R. Huntley station, or in case of serious trouble in the cables between the generating station and points "D," "E" and "F." It would also be possible to energize the entire system from the C. R. Huntley station in case of a total failure at the Seneca station. In either case it might be necessary to drop some of the load, as the cable capacities are not sufficient to carry all of the load from either end under peak-load conditions.

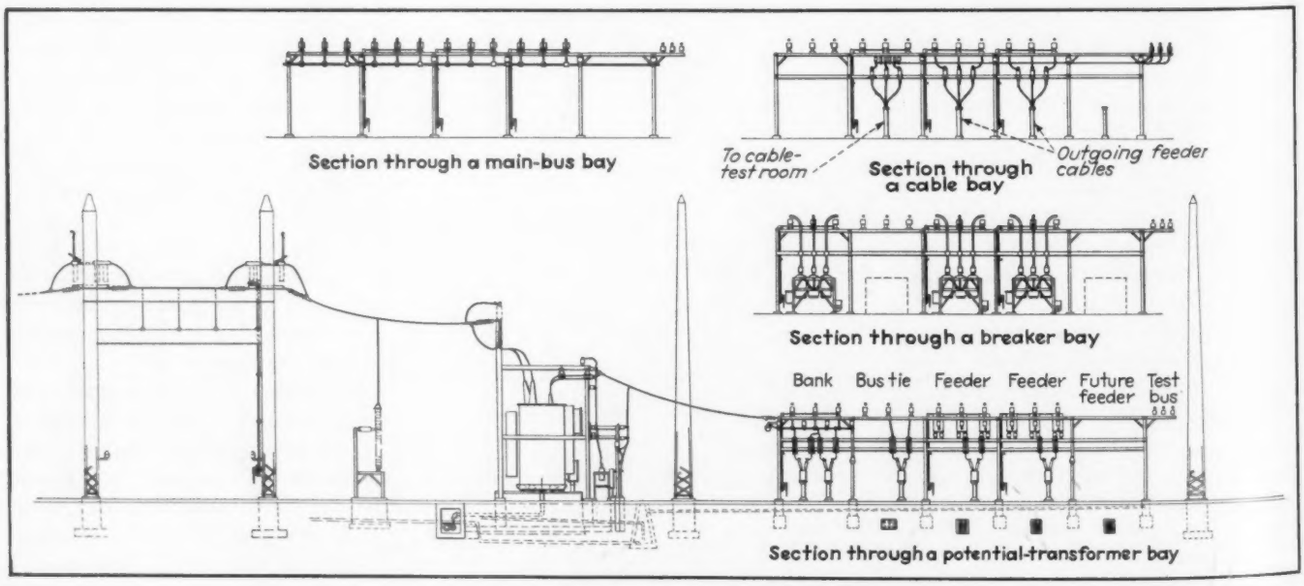


Fig. 3—Section shows liberal spacings

In the design of the terminal station itself every effort has been made to limit the extent of any trouble and to guard against the spreading of trouble from any section to any other section. All of the major equipment is located outdoors with very generous spacing between units, as may be seen from the general plan (Fig. 2) and the general cross-section (Fig. 3), showing the high-tension structures, transformers and low-tension structures.

Transformers are rated 30,000 kva., self-cooled, 40,000 kva. with forced air, 110/22 kv., three phase. They are equipped for changing taps under load, with a range of 10 per cent above and 10 per cent below normal voltage. Each transformer weighs about 145 tons. They were shipped in the lower part of the tank with special shipping covers and filled with nitrogen. Oil was pumped into the tank to displace the nitrogen without exposing the core and coils to air during assembly of the transformer. The upper part of the tank was welded in place after delivery. The air was exhausted from the tank and a vacuum of approximately 28 in. was maintained during the final filling operation and during the introduction of the nitrogen above the oil.

Power supply to the Seneca station is from the state-wide 110-kv. transmission system, which is supplied from the C. R. Huntley station; the 60-cycle generators at Niagara Falls, the frequency changers from the 25-cycle system and from the various generating stations throughout the Niagara Hudson system. The transformer banks at the Seneca station are supplied by separate 110-kv. lines from two different bus sections in the Gardenville station, about 3 miles from Seneca, where are installed the high-tension oil circuit breakers for the initial installation.

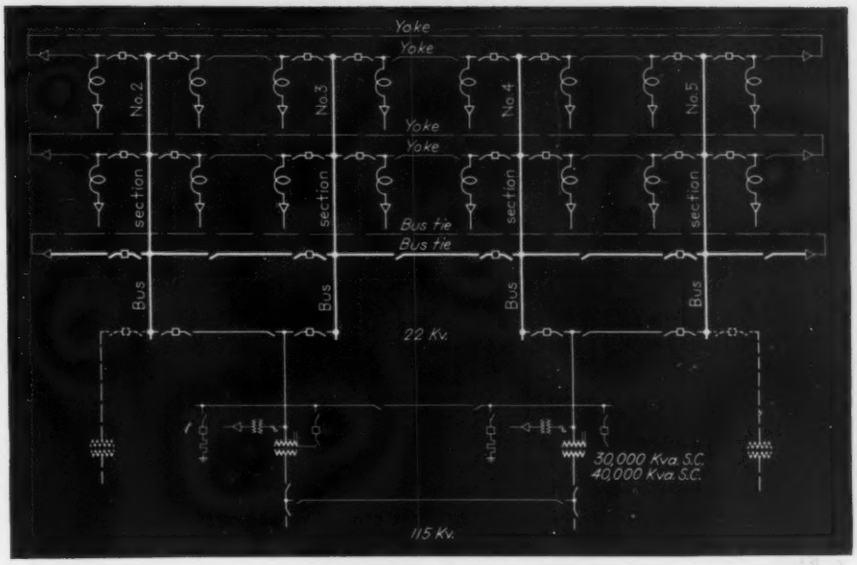


Fig. 4—Simplicity in bus layout

The 22-kv. structure is in four sections with provision for additional sections as required. Ultimately, there will be one transformer bank for each section of the 22-kv. bus. Bus tie switches are provided between sections to form a ring. There are four outgoing feeders and space for two future feeders from each bus section. The various sections are arranged side by side, thus placing each outgoing feeder cable directly opposite a corresponding feeder cable from an adjacent section. By means of individual yokes between the feeders of one section and the corresponding feeders on the adjacent sections it is possible to supply any feeder from an adjacent bus section under emergency conditions, even though there is no transfer bus. The individual cables in each group are served from different sections of the bus so that a failure of an entire section of the bus would involve only one cable in each group.

The station service building includes the control room with accessory equipment, such as storage battery, charging equipment, testing equipment, etc., and a 75-ton crane with sufficient headroom to remove the core and coils from the transformers. A transfer car is provided to move the transformers into the crane room. This crane room will be used to service all of the transformers in the various substations in the southeast section of the city, in addition to those at Seneca.

The relaying is carefully planned to provide prompt clearing of any fault and includes back-up protection, so that in case of a failure of any relay or breaker definite provision is made for tripping the necessary breakers to isolate the faulty circuit or bus section automatically. Each outgoing feeder is equipped with induction type over-current relays with instantaneous attachments and instantaneous ground relays. Each section

[*Continued on page 125*]

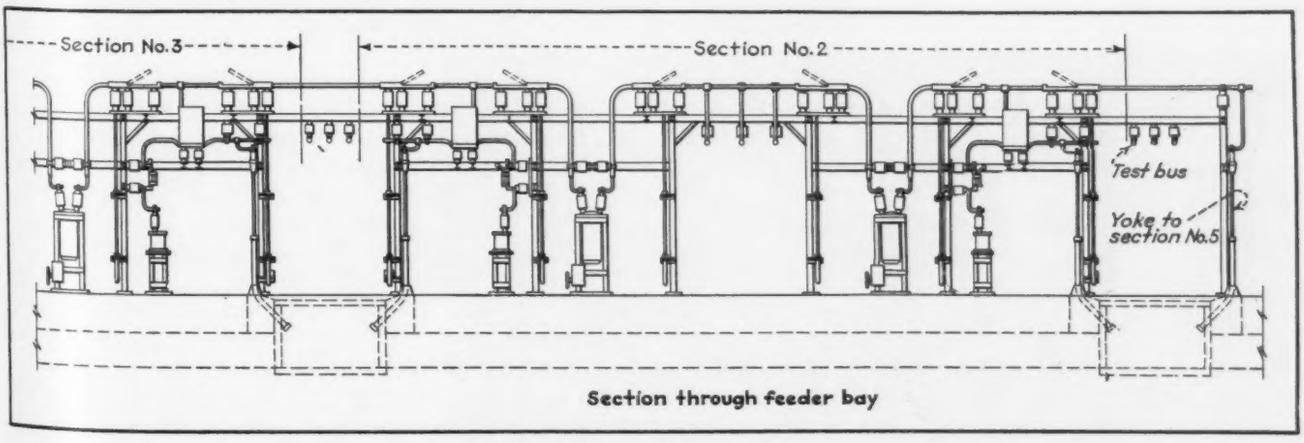
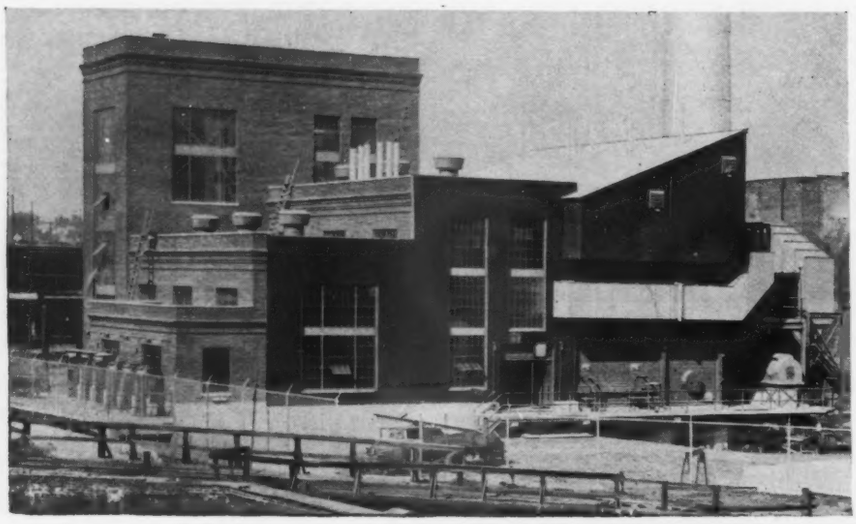


Fig. 5—The 22-kv structure

Typical cross-section through one section. All of the disconnecting switches are mounted upright on the top of the structure. All of the 22-kv. interconnections are copper tubing on rigid insulator supports. The 22-kv. oil circuit breakers are rated 1,000,000 kva., 34.5 kv. They are operated by 250-volt d.c. solenoid-operating mechanisms.

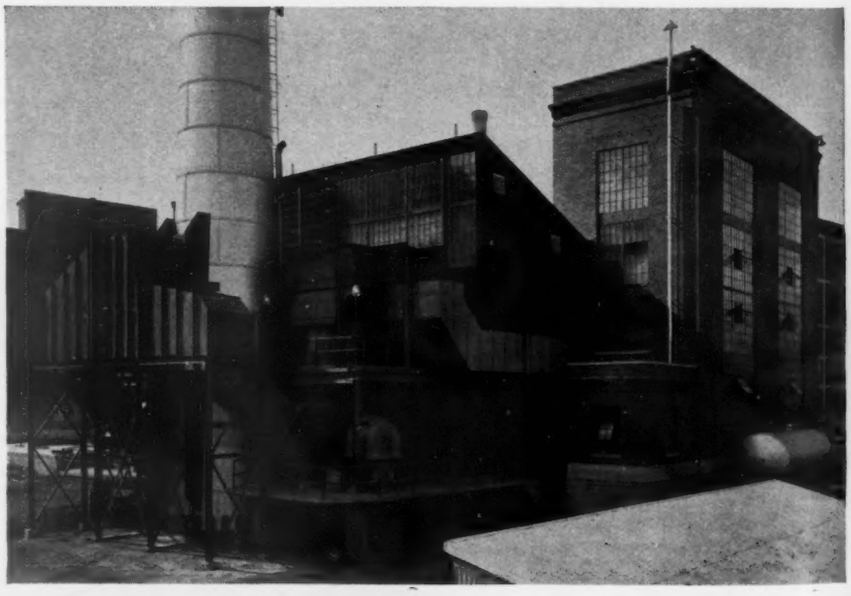
Utility Supplies Steam-

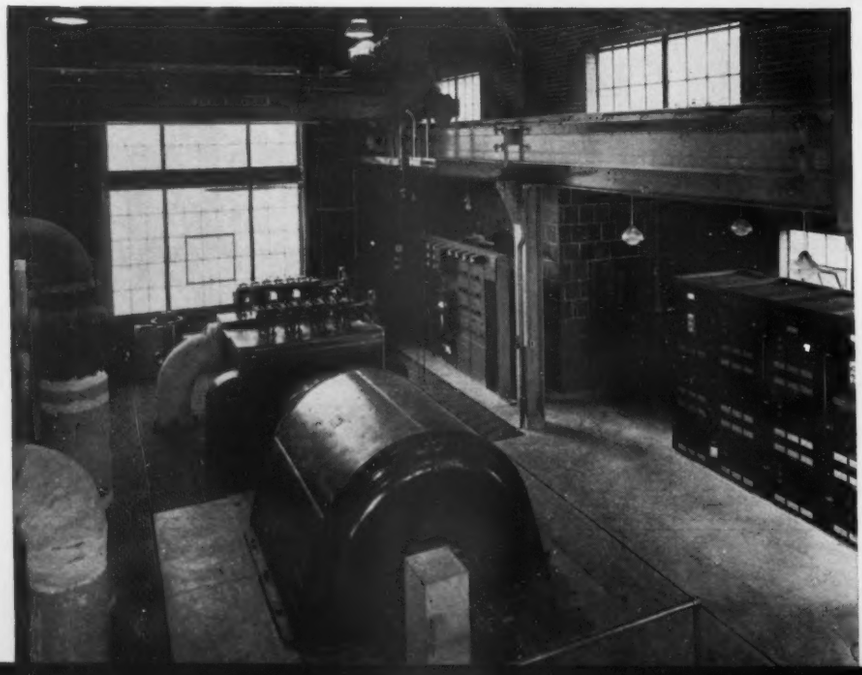


NOW in operation, the South Omaha plant of the Nebraska Power Company typifies modern thought in economical electricity production by utilization of heat taken from the turbine. This is a combined steam and electric service plant built by the utility in the area where the large packing industry of Omaha is concentrated. Electricity output of the station, wholly dependent on steam demand, since the turbo-generator is a back-pressure machine, is absorbed into the utility system. Steam at 160 and 20 lb. pressure is delivered to the Armour, Swift and Cudahy packing companies.

Semi-outdoor design

The economy of the plant structure is indicated by these two views. Practically all equipment associated with heat recovery from, and other handling of, boiler gases is out in the open. The first building section, next to the boilers covered with a corrugated steel canopy, contains the boiler fronts and firing aisle. The next section is the turbine room. Future extension of the plant is provided for by the end wall of corrugated steel. The taller adjoining building houses the water treating system, which is quite extensive since practically all of the boiler feed water must be treated. In the lower right-hand corner of the picture at the right and the lower left of the upper one may be seen the concrete top of the oil storage tank a few feet above the ground level.





The turbo-generator takes steam at 450 lb. and 700 deg. F. About half of the steam input may be bled off at 175 lb. and the remainder exhausted at 30 lb. for the two delivery pressures. The steam is generated in two Combustion Engineering boilers, each of 175,000 lb. per hour capacity, fired with natural gas, with provision for burners and storage for oil firing

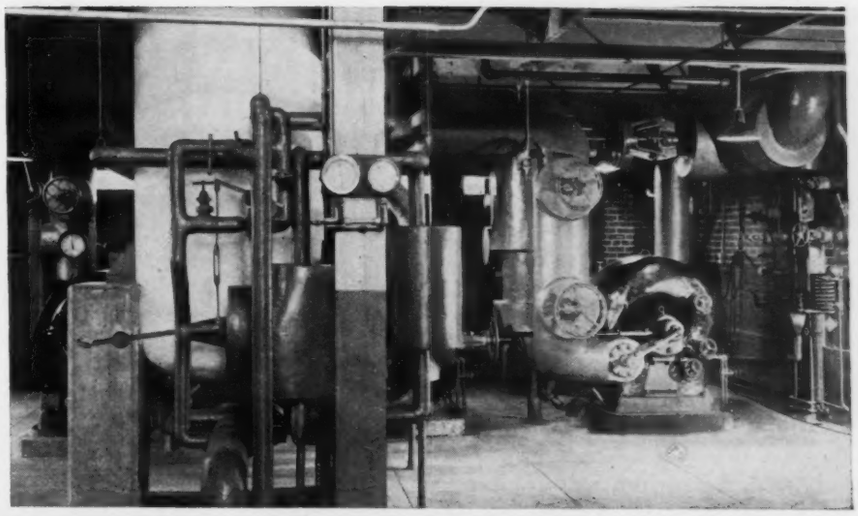
Turbine room

To the right in the background is the plant switchboard. Farther to the right and front is the assembly of inclosed air circuit breakers for station service. The turbo-generator is rated 5,000 kw., 80 per cent power factor, 13,800 volts, three phase, 60 cycles, non-condensing, automatic extraction at one point.

Electric Service to Packers

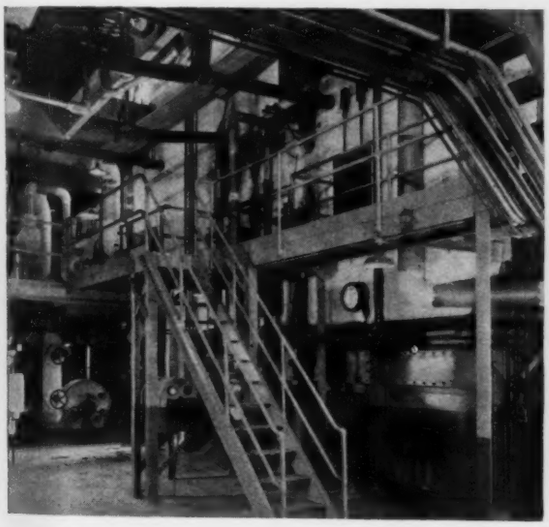
and equipped with forced- and induced-draft fans and Ljungstrom air preheaters.

The plant might be described as of semi-outdoor type, since a considerable part of the boiler equipment is not contained in the building and the boilers themselves are inclosed only in a fabricated structure of steel sheets and shapes.



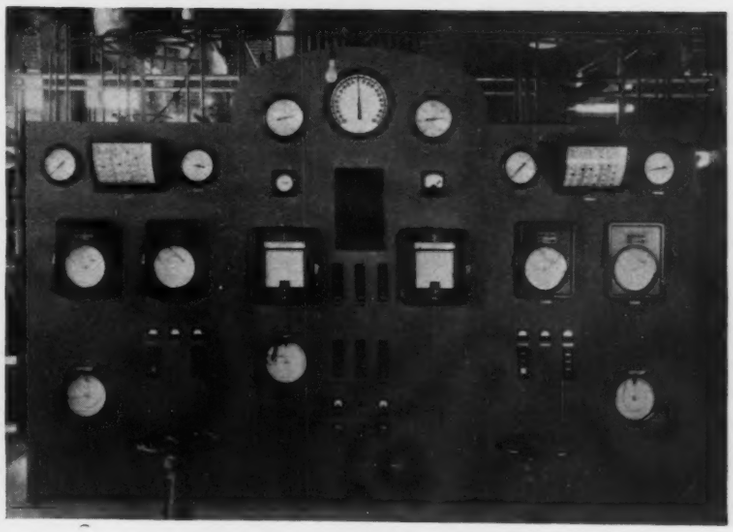
Boiler auxiliary bay

The bottom of the high-pressure heater appears at the left and at the right a turbine-driven boiler feed pump. On the right-hand wall are the continuous blow-down regulating valves and the water sampling piping.



At end of boiler No. 1

Orientation of this view of the boiler operation space is the same as of the lower one of the two plant exteriors.

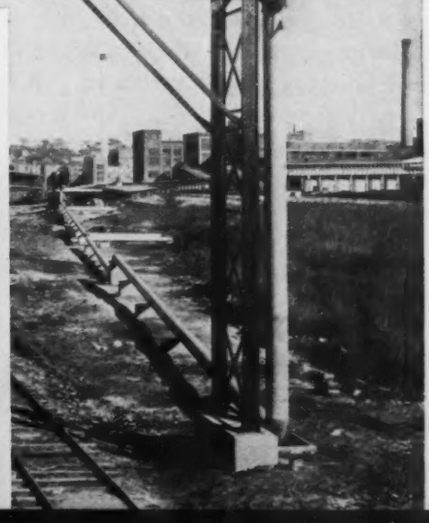


Boiler gauge board

The handwheels in the foreground are for gas flow regulating valves under the floor.

Steam distribution

In the left-hand picture appears the overhead steam line of two 14-in. pipes to the packing plant of Swift & Company. The other view shows the 12-in. 175-lb. steam line extending from the plant in the background and up over the tracks to the Cudahy Packing Company.



Editorials

S. B. WILLIAMS, Editor

Turbine Orders Fulfill Commitment

ORDERS for several large turbines have been placed within the last two or three weeks. The question has been raised as to whether this is the beginning of the greatly heralded buying splurge by the electric utilities. These orders appear to be the fulfillment of the commitments given to the National Defense Power Committee last fall by Eastern utilities in the industrial areas which will produce munitions to order one million kilowatts of new steam generating capacity.

Any additional capacity will depend entirely upon demand that the present forecasts. It now takes over two years for a large turbine to be made and placed in operation. There therefore must be considerable estimating of future load and that, of course, is not easy at this time. However, if the output continues to be greater than ever before, it must be obvious to anybody that additional capacity will have to be available to supply the 1941 peak.

Although not the largest part of the construction budget, the public gauges utility spending by generating plant purchases. Perhaps in the interest of better public understanding and good will, it would be best if more publicity were given locally by the power companies to their line and distribution construction. This is where the larger expenditures and the greatest contribution to recovery will take place.

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Advance in Power Generation Design

REMARKABLE progress is being made in the production of power from fuel. Hydrogen cooling, 3,600-r.p.m. units, high pressures and high temperatures all point to a continuation of past cost reductions in electrical generation. The first hydrogen-cooled generating unit went into operation at Dayton last year and was of 25,000 kw. Now manufacturers are willing to supply 80,000-kw. units at 3,600 r.p.m. Only those dealing with turbine design and materials can appreciate the major technical developments that brought this advance. For example, no commercial steel forging of last year could be found to stand the duty imposed on these large units, but the steel companies are now willing to supply a product that will fit this application.

Equally remarkable developments have been made in dealing with high pressures and high temperatures. Boiler feed pumps are now perfected. Boiler feedwater now can be had almost equivalent to distilled water. Steam at high temperature introduced a chemical reaction on metals and difficult problems in metallurgy and chemistry had to be solved. We doubt if any division of power supply has seen developments equal to those made in power generation. True, there have been some failures, but none of them were inherent in the advanced design. The industry can go forward adding new capacity with the assurance that it will be economical and reliable.

•

Compliance with Wage and Hour Act

WHILE most power companies are trying to abide by the provisions of the national wage and hour act, there are some companies that, because their business is wholly within the state, feel they are exempt. A study of the Consolidated Edison-NLRB case indicates that no power company is exempt where the use of its energy affects interstate commerce or government business. If service is taken by a telephone, telegraph or radio broadcasting company, by a transportation company in interstate operation, by a post office, and almost every company supplies service to one or more of these, then the company would be well advised to see that its labor conditions conform to the requirements of the act. A reading of the Supreme Court decision in the case cited would indicate that the relative size of these loads to the total is immaterial.

At first glance it was thought that power companies would not be greatly affected by the wage and hour act. As more study is given to the ramifications of the act it is becoming more and more apparent that complete compliance may cause considerable modification in certain operations. For instance, the question has arisen as to whether employees may sell appliances or take sales leads after working hours. What is the status of a sub-station attendant living in a company-owned house at the station and subject to call at any time during the twenty-four hours? Or of the employee of an industrial customer who reads a few meters? Or of farmers who read water level gauges?

It will be found, in general, that the rank and file of employees of power companies receive more pay and work fewer hours than are required under the law. There will be certain exceptions of course. But these problems and many others will clear up as time goes on and more interpretations of the act are made.

While it is possible that many utilities in their desire to comply will make changes in operation that were not necessary, the important thing is to try to comply and not take refuge in the intrastate character of one's business.

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Effect of Fluorescent Lighting on Load

NO analysis of the utility industry in the decade of the thirties will fail to underscore the leadership of lighting in load building. All the events connected with the Better Light-Better Sight movement make up one of the bright pictures in a period of gray and gloom. The public is prepared to "reach for the sun" as techniques and sources fulfill the earlier implications.

The announcement last year of commercially available fluorescent lamps brings up the necessity for reappraising the ultimate development of electric lighting. We can get 50 and 100 foot-candles with fluorescent lighting and we will. With tungsten filament lamps we seldom did because it often took too much energy and there was too much heat.

While we await this fulfillment, what are our immediate reactions? What will it do to the lighting load? In stores and offices where inadequate wiring has been the obstacle to improved lighting, the lamp should find ready acceptance. Through its use customers can double their lighting and at the same time obtain a color of light very close to the average outdoor daylight which people are really beginning to want. The utility greatly increases its kilowatt-hour sale with no increase in maximum demand or investment, for when a customer substitutes good lighting for meager lighting, the hours of use are greatly increased.

The fluorescent lamp is just beginning a period of expanding service similar to that which began with the tungsten lamp. And just as the lighting load has increased ten times the 1908 consumption with a constantly improved filament lamp, we may reasonably expect the lighting load to grow many times with the fluorescent lamp. Researches indicate that 100 foot-candles or higher are optimum. The development of fluorescent lighting puts us on the threshold of these higher levels.

The customer, however, will not secure these higher levels of illumination unless the utility is the guiding factor. The fact that lumens cost less with this new source is going to be a powerful incentive to substitute for incandescent lighting without increasing illumination levels or without considering its applicability.

In fact, this argument will be used in the selling by many people whose only interest is the disposal of lighting equipment. It will be offered as another way to reduce the light bill. It should be apparent, therefore, that fluorescent lighting can be an asset to utility load-building operations only if its application is properly guided by lighting company experts who see its possibilities and opportunities.

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Practical Employee Relations Conference

LAST week the Pennsylvania Electric Association held a two-day meeting on employee relations. The month before a similar meeting was held by the Southeastern Electric Exchange. These meetings are different from conventions where some well-known speaker discusses the subject. These are working meetings where those in attendance are really conferees exploring the subject from every angle of their personal experience.

There is a heightened interest in employee relations, not only in the utility industry, but in every industry. It is becoming so popular that in the haste to do something about it there is the danger that some serious mistakes will be made. Meetings such as these can do much to keep companies on the right track. For instance, one of the things that has gained considerable acceptance of late is the psychological examination and intelligence testing of applicants for jobs and even for people now on the payroll. Unless used by an expert, and even then sometimes, the information can be misleading. Also, there is the problem of vacations and for whom, methods of employee education, training for certain tasks, relations with organized labor, and a host of other things. Nothing can beat a good old bicker session, for that is what these meetings are when well conducted, for finding out the most practical approaches.

So well attended have been the meetings so far that any state association will find itself well repaid for its efforts to engage in such an activity.

"JUST PICTURE ROMANCE"

Some time yet before the May 1 deadline for entries in "Electrical World's" Prize Picture Contest—
but not too much time to get a good shot of a good subject, make a good print, write a good caption.

Doesn't Make Sense, Somehow

By CARTER FIELD

This noted journalist gives his personal comments and interpretations on current happenings affecting the electrical industry. His background and his location at Washington make his thoughts informative and interesting even though all may not agree with him

TWO prospectors were standing up against a bar in old Cripple Creek, Colorado, during the boom days. One of them poured water into his whiskey, every round. The other regarded the operation sourly.

"What's the idea of water in your whiskey?" he demanded.

"Well," said the second, "I find I can drink more, that way."

The first puzzled for a few minutes, then said:

"You aim to get drunk, don't you?"

"Yes," the second replied.

More puzzled silence, then:

"Don't sound like good economy to me."

One man's logic is a crazy quilt to another, and there is always the possibility that either may be wrong. But let's look at the maneuvers about TVA since the olive branch waving of the Administration toward the electric industry.

First, as every one knows, TVA threw out the window the policies pursued up to that time by David E. Lilienthal and approved by John Rankin, leader of the House public ownership bloc, and by George Norris, leader of the same bloc in the Senate. TVA suddenly agreed to pay somewhere between 15 and 25 million dollars more for the Chattanooga and Memphis properties than Lilienthal had intended, or Rankin thought plenty.

Spending spree hoped for

Harry Hopkins, No. 1 man at the President's ear, told Senate leaders during his confirmation battle how he longed for peace and prosperity in the electric industry, with the threat of government competition removed. The whole hope was to start a spending spree by the electric industry which would revive prosperity and, incidentally, insure a New Deal President next year to carry on the Roosevelt policies.

But, with that objective, and its importance in making sure of the continuance of the New Deal in power after next year fully realized, it is difficult for some to understand certain events since.

First off the reel, why did Mr. Hopkins have to lay so much stress on very low rates in his Iowa business appeasement speech? No one has contended that possible investors in the electric industry have to be promised the continuance of high rates. Every one who has been consulted here thinks the investors would be eager to put their money in privately owned utilities if they could have just two assurances:

1. That the government would not build any more hydro-electric projects.

2. That the government would not grant any more free gifts and low interest rate loans to subsidize local public ownership electric systems.

Investors already knew that, with government regulation, there is no chance of a bonanza in an investment in the electric business. All they need to be assured of is that their properties will not be rendered worthless by government-subsidized competition. This is tremendously more important to an investor thinking of putting his money in utilities than is any nice talk about modifying the tax structure to encourage business. Nobody with much money to invest can be kidded to any considerable extent about federal taxes when he knows the government is spending more than it is receiving, and federal debt up.

But now let's consider the TVA appropriation in Congress. In a surprise move the House cut out some 17 millions from the bill. This would have stopped work on the Gilbertsville Dam, already under construction, and prevented a start on the Watts Bar Dam. Now it is possible that Congress would approve the Gilbertsville Dam for flood control and navigation alone, especially when millions had already been spent on it. Senator Carter Glass took that position. But it is almost unthinkable that it would have approved the Watts Bar Dam on such grounds.

Reciprocal pork

That was, pure and simple (1) to carry out the TVA program and (2) to provide more electricity which the government could sell.

Also, it was far from easy for the Administration to hold those TVA items in the bill. Change of half a dozen votes in the House would have defeated the Watts Bar Dam. Needless to say, all the pressure the Administration could bring to bear was turned on to save this item. Pep meetings of the House Democrats were held. They were told if they did not hang together they would hang separately at the next election. Men who wanted pork for their districts were told they would never get it unless they voted for TVA pork.

The worst phase of the whole thing, if one considers only the idea that the Administration wanted to reassure possible investors in the electric industry, can be realized by studying the rollcalls on these items. It will be seen that, in both House and Senate, men voted with the Administration if they live in sections where there is an agitation for more federal pork in the way of hydro-electric developments!

In short, no congressman wanted a possible opponent next year to say

[*Continued on page 126*]

News OF THE WEEK

Public Attitude Change Seen Due to Improved Customer Relations

Pennsylvania Electric Association told that consistent practice of good management and more friendly contact will win public—Meeting in Philadelphia discusses ways to better operating practices

People are more interested in their own economic security than in such matters as public or private ownership of utilities, believe Roosevelt is their "best bet" in the White House and rate utility men below automobile manufacturers but above bankers, Elmo Roper, surveyor of public opinion, last week told nearly 300 members of the operations section, Pennsylvania Electric Association meeting in Philadelphia.

In the past five years, he said, the electric utility business has improved in its customer relations. The public is aware of that improvement and consequently is much more friendly. Two or three times as many people think labor unions are in need of reform as there are that think utilities or stock exchanges need reforming. Henry Ford, he said, is considered closest to an ideal business leader because he treats his labor well and offers a good product at fair prices.

Two-day session

Employee relations, customer relations and public relations were subjects of discussion at the two-day convention and embraced supervisory employee training, accident prevention, motor transportation and stores. Following the program, members visited nearby Philadelphia Electric to watch demonstrations of customer's service, appliance service, operations, stores and transportation sections.

"Industrial relations" and good management are one and the same thing, William Conover, assistant director of industrial relations, U. S. Steel Corp. of Delaware, told his audience. Problems of labor relations, he said, are not solved by merely signing labor agreements. Consistent practice of good management from the top down through every level of supervision is the only sure and permanent answer.

H. K. Breckenridge, personal director, West Penn Power, and R. C. McKinnis, manager of employment and training, Duquesne Light, described supervisory training activities in properties with widely scattered territories and in those operating in large metropolitan centers of concentrated business. A better-informed supervisory personnel, better teamwork among departments and helpful criticism for executive guidance from men closest to the firing line were among benefits cited by Mr. Breckenridge as a result of West Penn's three-year-old plan.

"A Salesman Looks at Safety" was

UTILITY OPERATIONS—Members of the operations section of the Pennsylvania Electric Association viewed ways of better customer and public relations at their meeting in Philadelphia last week. L. to r.—Ira L. Craig, Philadelphia Electric; John M. Orr, Dusquesne Light; B. P. Carey, Philadelphia Electric. A step in the pole-top resuscitation demonstration is seen at the right

RANGE CAMPAIGN—The electric cookery committee of the Electrical League of the Niagara Frontier met last week to formulate a two-month campaign for electric ranges to start April 10. Standing, l to r.—Russell P. Sackett, George Keipper, Jr., Merle Bedient, W. S. James, Merrill E. Skinner, president of the League; Walter S. Schmidt, chairman of the committee; D. B. White, S. Coleman, P. W. Evans, H. P. Fillmore. Seated, front— C. O. Curtis and R. H. Davison. Seated, rear, l. to r.—Meyer Goldman, F. L. Riehle, Samuel S. Vineberg, manager of the League; Carl Rohrer, Charles Bell, C. K. Stein, E. J. Delahoyde, C. R. Barteck, and J. L. Johnson

the subject of Roy H. Warmee, sales manager, Philadelphia Coke Co., and speaker at the first day's luncheon conference. Selling a safety program, he said, means reaching for the dramatic appeal to the emotions of employees, with good advertising, showmanship, personal effort and all the media employed by a good sales department.

Meetings the first afternoon included slide film presentation of "Safe Methods of Pole Unloading" by G. E. Balch, general storekeeper of Duquesne Light, and of "Pole Top Resuscitation" by E. W. Osterreich, general superintendent of distribution, Duquesne Light. Meetings were held concurrently by the motor transport and stores group.

B. B. Badiman, vice-president, Autocar Co., described improvements and refinements in modern automotive equipment used by utility companies and outlined prospects for future transmissions, springing arrangements and Diesel trucks. Geo. O. Pooley of Mack-International Truck Corp. spoke on "The Human Side of the Motor Truck as an Aid to Business Profit."

At the final session, devoted to customer relations, Elmo Roper spoke on "What the Customers Think of Utilities" and Henry S. Flanagan outlined policies and procedures behind the current methods of sampling customer-employee interviews as developed over the past five or six years by Philadelphia Electric.

W. H. Swinney, president of Pennsylvania Electric Association, presided at the closing luncheon session and introduced Henry G. Dooley, associate editor ELECTRICAL WORLD, who spoke on "Public Relations—Brought Down to Earth."

•

Miami Voters Recall Mayor and Commissioners

Mayor Robert R. Williams and Commissioners John W. DuBose and Ralph B. Ferguson were recalled by an overwhelming vote of Miami, Fla., voters last week.

The recall election was the outgrowth of charges made by Bryan Hanks, president of Florida Power & Light, that a bribe had been sought to settle the long-pending rate controversy. The city officials had been cleared of the charges in the indictment. The utility lost its rate plea and was ordered by the court to return $4,000,000 to its customers.

•

Oppose Utility Merger

Sands City, Okla., officials have succeeded in having the Corporation Commission postpone hearings on the proposed consolidation of the Oklahoma Power & Water Co. of Sands Springs and the Public Service Co. of Oklahoma, Tulsa. Officials declare the consolidation would deprive Sands Springs of its utility, which last year agreed to reduce rates.

Range Drive Planned for Niagara League

Plans for the spring electric range promotion over a period of two-months were discussed last week at a meeting of the Electrical League of the Niagara Frontier. The electric cookery committee, under the chairmanship of Walter S. Schmidt, manager of appliance sales of the Buffalo Niagara Electric Corp., met at a luncheon, prepared entirely with electrical devices, served by the home service staff to the committee composed of the electric range manufacturer and distributor executives, utility representatives, selected dealers and League officials.

As a result of the meeting, dealers will be approached by their distributors and manufacturers and asked to express their preference for a promotional activity combining a selection of one or more of the following features:

1. The advisability of developing a uniform trade-in allowance to be featured in the newspaper advertising, radio broadcasting, light bill enclosures, window trims and banners.
2. A uniform trade-in allowance which will be offered and advertised as above, but which will apply only to one range in each manufacturer's line, that range to be advertised as a special feature.
3. The making of a premium offer in place of the trade-in allowance.
4. A limerick contest, or a prize drawing contest, or combination of salesmen, dealer and prospect contest.
5. An electric range show.

A working sub-committee composed of C. O. Curtis, H. P. Fillmore. F. L. Riehle, D. B. White and Mr. Schmidt is to review the distributors' reports on their dealer survey and prepare recommendations for consideration of the committee as a whole.

•

Orders NLRB Election

The NLRB has directed that a run-off election be held within 45 days among employees of Consumers Power Co., Jackson, Mich., to determine whether or not they wish to be represented by the Utility Workers Organizing Committee, CIO. The vote taken from January 10–13 resulted in 1,164 for the CIO union, 1,072 for the AFL's International Brotherhood of Electrical Workers and 506 votes for neither.

•

G. E. Restores Salary Cut

All salary cuts put into effect in April, 1938, by General Electric Co. will be restored in full on April 1, Gerard Swope, president, announced this week. Reductions were made on a graduated scale on salaries above $2,000. Neither the reductions nor the restorations affected wage rates.

REA Opens Intensive Appliance Sales Drive In Ten Iowa Co-ops

Objective is to make five years' progress in 60 days in appliance saturation—Hopes technique can be worked out to bolster revenues on projects throughout the country—Slash installed costs

More than 8,000 farm customers of ten rural electrification cooperatives in Iowa will be subjected to an intensive appliance sales campaign, started this week, with the avowed objective of making "five years' progress in 60 days" in appliance saturation.

Much hangs on the outcome of this experiment, which is being promoted and aided by the Rural Electrification Administration in the hope that a technique can be worked out to bolster revenues on its many projects throughout the country. Rural territory is thin; the financial success of these undertakings hangs on the supposition that, once power is available at the flip of a switch, the farmer will find it worth while to use it far more intensively than does the city dweller.

To spur power use

Just how far the REA can move the farmer to act, as the paper plans say he should, is the one big worry. The REA knows that high utilization requires expensive fixtures and appliances. Returns from the more than 350 REA projects so far energized are disappointing. Recent testimony of REA Administrator John M. Carmody before Congress shows that during the first six months of service these projects have realized only 46 per cent of their anticipated revenue, and that even after 18 months the average has climbed to 92 per cent. How to accelerate this curve is the present problem of REA.

What holds up consumption, it is apparent, is the simultaneous necessity of wiring the farm buildings, buying fixtures, and acquiring appliances. The farmer has a tendency to hold these purchases to a minimum. For this reason the problem becomes one of reducing these costs. Using the fact that each project opens up a large but concentrated market as bait, the REA has approached manufacturers, distributors and dealers with the proposal that profit margins be reduced and sales efforts intensified in an effort to speed up the purchase of equipment. The plan gets its initial tryout in the current Iowa experiment, where installed costs will be slashed by from 25 to 35 per cent in an effort to prove that the resulting volume will more than make up for the low margins.

Household equipment will get the bulk of the sales effort, with the primary pressure on electric ranges, followed by refrigerators, mixers, lighting fixtures, and other household appliances. Cooking schools and demonstrations will be held at many points throughout the area, whenever possible with the cooperation of the local dealer, newspaper or others. REA personnel will be prominently in the picture but there is no disposition to short-circuit the trade. It is hoped that, if the experiment is a success, it can be turned over to private business and worked out for other regions.

•

Awarded $100 Grand Prize in Water Heater Contest

The retail salesman's letter on "How I Sell Electric Water Heaters," which won a prize of $10 for W. K. Powers, Northern States Power Co., Minneapolis, Minn., in the May, 1938, monthly contest was recently selected as the best letter of the year by the judges, the Modern Kitchen Bureau has announced. A Grand Prize of $100 was awarded Mr. Powers for his winning letter.

Judges unanimously awarded an Honorable Mention to two other electric water heater retail salesmen: E. H. Dowson, The United Illuminating Co., New Haven, Conn., and Albert Gruber, Washington Water Power Co., Kamiah, Idaho, for their constructive letters entered in monthly contests.

•

Protector Tubes Aid 110-Kv. Line Service

A decided improvement in service reliability during two lightning seasons has been obtained on the 110-kv., double-circuit tie line between the Edgar station of Boston Edison Co. and the Millbury dispatching station of the New England Power System, according to C. A. Corney, superintendent of engineering of the former organization, in a recent discussion before the Boston section of the A.I.E.E.

This line is carried by steel towers with relatively high footing resistance (average range 50 to 400 ohms) which cannot be economically lowered. Among others, it serves important industrial loads, including paper mills, which are closely dependent on continuous service for successful production.

A section 30 miles long, covering 60 circuit-miles, has been equipped with protector tubes of special concentric

WINS AWARD—Howard F. Ilgner (left), superintendent of Milwaukee's bureau of electrical service and head of the Electrical league, presenting to Glenn A. Wilson (right), president of the Milwaukee Real Estate Board, No. 1 award for the 1939 model home which complied with every specification of the national adequate wiring bureau. Nels Christopherson, secretary of the league, and John J. Roache, secretary of the Real Estate board, (at extreme right), at the recent ceremony.

fiber construction and small diameter bores with discharge ports and electrodes. In case of flashover through the tube the ensuing arc builds up a pressure and is blown out in a few cycles before the relays can operate to trip the line circuit breakers.

The gas pressure built up is due to volatilization of a certain amount of the fiber. The life of the tube depends on the weathering of the tube and on the number of operations. Targets on the tubes indicate the number of operations. The company has installed 1,300 of these tubes on this line. A quick-acting oscillograph has been installed at one end for automatic operation by ground current. This indicates the number of cycles before extinguishment of the arcs resulting from lightning discharge.

•

Rhode Island Board Headed by McLyman

Public utility regulation in Rhode Island underwent an organizational change last week when Gov. William H. Vanderbilt named Horace L. Weller of Providence as director of the newly established department of business regulation and appointed Benjamin M. McLyman as administrator of public utilities, succeeding Michael DeCiantis, chief of the division of public utilities under the now defunct administrative code act.

Mr. DeCiantis and Dr. Charles A. White, superintendent of the bureau of rates and tariffs, resigned together. Mr. Weller has been counsel for the Short Line bus interests and Mr. McLyman served as Attorney-General of the state for a number of years.

Under the new arrangement the regulation of utilities by the administrator will form a part of the work of the business regulation department under a law which transfers such functions from a former state department.

•

Pennsylvania Commission Expenses Attacked by Utility

Describing some of the expenses of the Pennsylvania Public Utility Commission as "extravagant, unnecessary and unconnected with necessary regulation," the Bradford (Pa.) Electric Co. has questioned the power of the commission to assess utilities for its operating expenses.

The utility objected to a general assessment to defray commission expenses of $567,757 from June 1, 1937, to May 31, 1938, while not refusing to pay assessed costs in specific rate cases.

SEC to Hold Hearings On Columbia Gas Plan

The first of the integration plans filed with the SEC last December to come before the commission for official action will be Columbia Gas & Electric Corp. The SEC announced that a hearing will be April 3 at 10 o'clock in Washington on the application for approval of the proposed plan of integration under the holding company act.

TVA Shows Increase in Home Appliances

Residential consumers using TVA power purchased more than $2,000,000 worth of electrical appliances during 1938, according to reports from more than 400 private appliance dealers to the TVA.

Sales for the year totaled $2,098,500, as against $1,820,500 in 1937 and $1,033,800 in 1936, John B. Blandford, Jr., general manager, declared.

Average sales per customer in 1938, based on the weighted average number of customers connected each month, were $46.71. Mr. Blandford stated that a large proportion of the total sales for the year were made without trade-ins.

The total number of residential customers, exclusive of those on government reservations, at the end of 1938 was 77,200, as against 30,200 at the end of 1937 and 20,300 at the end of 1936. Most of the customers were served by municipalities or cooperatives.

Appliances purchased and put into use by TVA residential power consumers included 4,701 electric refrigerators, 2,449 ranges, 814 water heaters, 597 water pumps, 921 residential electric heaters, 2,654 washing machines, 77 ironers, and 26,936 miscellaneous appliances. Appliance sales to commercial customers in 1938 totaled $120,780, not including motor sales to commercial and industrial consumers aggregating 3,676 h.p.

•

Fort Wayne Asks Rehearing in City Plants Tax Case

City of Fort Wayne has filed a brief in the Indiana Supreme Court asking rehearing of the suit testing constitutionality of the state law taxing city-owned utilities, following recent decision of the Supreme Court reversing a decision of Allen Circuit Court which held the law unconstitutional. The Supreme Court ruled that the city light and power works must pay the tax, which, with penalties, now totals about $150,000.

Meanwhile, city officials are watching the progress of a bill in the Indiana Legislature repealing the tax. The Senate has passed the measure and it had been advanced to second reading in the lower House.

•

FPC Issues Annual Electric Rate Study

Electric rate data as of January 1, 1938, covering residential, commercial light, commercial power and industrial consumers in 191 cities of 50,000 population or more, were reported this week by the Federal Power Commission.

The combined population of the 191 cities is 42,826,440, or 52.3 per cent of the total population in communities of 250 or more. A total of 149 utilities serves these cities, privately owned utilities serving all but seventeen. In nine of these seventeen cities competition exists between publicly owned and privately owned utilities.

During 1937, no changes in residential bills were made in 106, or 55.5 per cent, of the 191 cities. Residential rates were reduced in 85, or 44.5 per cent, of the cities, while two cities reported both increases and decreases.

As in previous reports by the commission, wide differences in the charges for residential service are shown. However, the report shows that for the country as a whole the average rates for 25, 100 and 250-kw.-hr. were 5.7, 4.0 and 2.9 kw.-hr., respectively, in 1937, as against 5.8, 4.1 and 3.0 cents per killowat-hour in the previous year.

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Would Abolish Power Body

Assembly Maurice Whitney, Rensselaer County, Republican, has introduced a bill abolishing the New York State Power Authority and repealing provisions relating to development of the St. Lawrence water-power resources in co-operation with Canada. The bill has gone to the commerce and navigation committee for consideration.

•

Board Reorganization Begun

George C. McConnaughey, chairman of the Ohio Utilities Commission, has announced the resignation of Louis F. Dabe of Columbus, chief engineer of the gas and electricity division, as the first step in a projected reorganization of the commission's staff.

SEC Asks More Data on Integration Plans

Formal consideration of integration plans filed by utility holding companies under the utility act is expected to be taken by the Securities and Exchange Commission in the near future. So far plans of American Gas & Electric, Columbia Gas & Electric, Utilities Power & Light and North American Co. have advanced considerably through the SEC mill.

Last week the SEC requested a number of holding companies to supply additional information to support their claims to retain additional systems under the integration clause of the act. It is expected that this additional information will aid materially in speeding the work of the commission.

During the past several months conferences between SEC members and utility representatives have been held. Much has been accomplished in these conferences where the SEC gained an understanding of the utility viewpoint and the utilities learned the objectives of the commission. The showdown will come when the SEC begins to take formal action on the integrations plans already submitted.

•

Eight College Graduates Get Coffin Fellowships

Eight college graduates have been granted Charles A. Coffin fellowships, totaling $5,000, for use in carrying on advanced scientific research during the next school year, it was announced this week by W. W. Trench, secretary of the foundation. The fellowships were established by General Electric Co. in 1922 to honor its retiring president and founder.

The students will carry on their work in five different educational institutions, three at Massachusetts Institute of Technology, two at Johns-Hopkins University and one each at Columbia, Harvard and Ohio State universities.

•

AFL Petition Dismissed

The NLRB has dismissed the certification petition filed by the International Brotherhood of Electrical Workers (AFL) on behalf of employees of the Tennessee Electric Power Co., Chattanooga. The board action followed a secret ballot election held June 13-15, resulting in a 571 to 514 count against the AFL union, with 98 votes challenged, two void and one blank. The union failed to get a majority approval.

FIRST LIGHT PLANT—Visitors to the Franklin Institute, Philadelphia, viewing the first commercial electric power plant of the late inventor, Thomas A. Edison. The plant was assembled in Sunbury, Pa., nearly a half century ago

Tie Circuit Sought for Boston District

Permission to build a second 110-kv. steel tower circuit 17.8 miles long between Tewksbury and Melrose, Mass., has been requested by the New England Power Co. from the Massachusetts Department of Public Utilities on the ground that increasing loads require preparation for additional capacity for the affiliated New England Power Association properties in the north Boston suburban district.

At a hearing last week Clyde A. Booker, transmission line engineer, stated that the design duplicates the initial circuit layout which went into service in December, 1936. It calls for semi-flexible steel towers, with three 300,000-circ.mil copper power conductors and two $\frac{7}{16}$-in., high-strength galvanized steel ground wires. The second tower line is planned for a location 62.5 ft. from the first between tower centers, the right-of-way ranging from 200 ft. to about 250 ft. in width.

Arthur E. LaCroix, assistant vice-president New England Power Service Co., stated that under load conditions prevailing in the fall of 1938 the Eastern Massachusetts Electric Co. system would not have been able to supply the demand of the retail properties and municipal customers in the event of the Tewksbury-Melrose line and the largest steam unit of the area being simultaneously out of commission. If industrial loads develop there will be a shortage of power next fall under the above conditions, and in any event the additional circuit will be needed in 1940.

New England Power desires permission to build also, having possible war demands in mind, and wishes to go ahead with the tower-footing construction during the periods of frozen swamps and subsequent dry weather in order to be able to complete the construction of the circuit more economically and at short notice, should load conditions so dictate. The commission took the case under advisement, following remarks of several witnesses in opposition to additional overhead construction, who contended that the building of a second circuit passing in part through the outskirts of a prospective residential region would impair property values.

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Recommends Power Project

Modification of the authorized project for the improvement of the Connecticut River between Hartford and Springfield and Holyoke has been recommended to Congress by the Secretary of War on the basis of a report by the Chief of Engineers. The report recommended the construction of a lock, dam and power plant at Enfield Rapids, Conn., by the federal government and the raising of bridges to provide a 20-ft. clearance by local interest. Estimated first cost is $12,344,000, with $200,000 annually for maintenance and operation.

Program of Midwest Power Group Issued

Details of the program of the Midwest Power Conference to be held at the Palmer House, Chicago, April 5-7, have just been announced.

L. W. Wallace, director division of engineering and research, Crane Co., Chicago, will discuss "The Achievements of Research in Power," and Alex D. Bailey, Commonwealth Edison Co., will talk on "Developments in Central Station Power Plants." At the session on electric power generation, transmission and distribution, Herman Halperin, Commonwealth Edison Co., will discuss "Modern Developments in Power Cables," and G. G. Post, Wisconsin Electric Power Co., "Some Fundamentals of Generating Station Design."

Rural Electrification will be given attention at the sessions, with B. E. Miller, Wisconsin Power & Light Co., presenting a survey of the rural service of the Wisconsin utilities and V. M. Murray, Wisconsin Development Authority, discussing "Contributions from the Rural Electrification Administration Program in Wisconsin." A session on power equipment will also be held, O. A. Leutwiler, chairman.

On April 6 a joint luncheon will be held with the A.I.E.E. and in the evening a joint dinner with the A.S.M.E. and A.I.E.E.

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Heating Engineers Appoint Members to Research Group

The 1939 organization of the committee on research of the American Society of Heating and Ventilating Engineers has been announced by W. L. Fleisher, chairman, following the society's annual meeting in Pittsburgh. The new members are R. E. Daly and H. J. Rose, research fellow of the Mellon Institute, Pittsburgh.

Included in changes of technical subcommittee personnel is the creation of a new "committee on instruments" charged with the responsibility of recommending standardization of instruments in psychrometric work and to outline limitations in the use of instruments for various types of applications. The chairman of this new committee is Prof. D. W. Nelson of the University of Wisconsin.

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Laboratories Form Council

Leading research and testing laboratories of the country, have mutually bound themselves together in the American Council of Commercial Laboratories to maintain testing, research, inspection and the laboratory art as a whole upon a high plane and to conduct their operations in such a manner as to insure competency and reliability. Member laboratories are located from coast to coast with branch laboratories and inspection stations in every important city and industrial center in the country. D. E. Douty, 1415 Park Ave., Hoboken, N. J., is secretary of the council.

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Rate Schedules Requested

All electric light and power companies in British Columbia will shortly be asked by the British Columbia Public Utilities Commission to file a schedule of rates, according to Dr. W. A. Carrothers, chairman of the board.

Meetings

Northwest Electric Light and Power Association—Business development section, Portland, Ore., March 16–18; engineering and operation section, Seattle, Wash., April 19–22; accounting and business practice section, Vancouver, B. C., May 26–27. Berkeley Snow, secretary, 707 Spalding Bldg., Portland, Ore.

Edison Electric Institute—Sales committee, Edgewater Beach Hotel, Chicago, Ill., March 20–24. Bernard F. Weadock, managing director, 420 Lexington Ave., New York, N. Y.

Association of Iron and Steel Engineers — Spring conference, Tutwiler Hotel, Birmingham, Ala., March 27–28. Brent Wiley, managing director, Empire Building, Pittsburgh, Pa.

Greater New York Safety Council—Annual convention, Hotel Pennsylvania, New York, N. Y., March 27–29. W. Dent Smith, Room 3615, Lincoln Bldg., New York.

Southeastern Electric Exchange — Annual conference, Ponce de Leon Hotel, St. Augustine, Fla., March 30–April 1. J. W. Talley, executive secretary, 308 Haas-Howell Bldg., Atlanta, Ga.

Oklahoma Utilities Association — Annual convention, Tulsa Hotel, Tulsa, Okla., April 3–4. Kate A. Niblack, secretary, 625-626 Biltmore Hotel, Oklahoma City, Okla.

Midwest Power Conference—Palmer House, Chicago, Ill., April 5–7. L. E. Grinter, dean Armour Institute of Technology, Chicago, Ill.

Missouri Valley Electric Association — Engineering conference, President Hotel, Kansas City, Mo., April 6–7. I. D. Pettegrew, acting director, 1527 Sharp Bldg., Lincoln, Neb.

Missouri Association of Public Utilities—Annual convention, Muehlebach Hotel, Kansas City, Mo., April 12–14. Jesse Blythe, assistant secretary, Merchants Bank Bldg., 101 West High St., Jefferson City, Mo.

Maryland Utilities Association — Spring meeting, Lord Baltimore Hotel, Baltimore, Md., April 14. Warren D. Haley, secretary, 16 Carroll Av., Takoma Park, Md.

American Institute of Electrical Engineers —Southwest district meeting, Houston, Tex., April 17–19. H. H. Henline, national secretary, 33 West 39th St., New York, N. Y.

Electrochemical Society—Spring convention, Columbus, Ohio, April 26–29. Dr. Colin G. Fink, secretary, Columbia University, N. Y.

Plan for National Lighting Activity

A nation-wide Christmas outdoor lighting contest is in prospect for this year, according to George E. Lewis, manager Rocky Mountain Electrical League.

As a result of negotiations with A. H. Kessler, North Central Association of Electrical Industries, Minneapolis, plans for a large-scale intercity contest next Christmas are well advanced, Mr. Lewis said. Washington, D. C.; Portland, Ore.; Cleveland, Pittsburgh and Kansas City have become interested in the venture, he add, and indicated that either local electrical associations or chambers of commerce would sponsor the activity in the various localities.

During the past Christmas season the number of towns and cities in Colorado, New Mexico and Wyoming that engaged in Christmas lighting was practically double that of any previous year. In the territory of the Rocky Mountain league this activity has been carried on for nearly twenty years, Mr. Lewis said.

•

Columbia Gas & Electric Stock Reduction Approved

Stockholders of Columbia Gas & Electric Corp., at a special meeting in Wilmington, Del., this week, approved the recommendations of the management and authorized the proposed cut of common capital to create a special capital surplus of $182,044,723, available for all charges to surplus which arise out of transactions prior to January 1, 1938, but not available for dividends.

Approval was given by more than 70 per cent of the common, more than 66 2/3 per cent of the preference and more than 68 per cent of the preferred stocks. The negative vote was less than 0.75 per cent of outstanding shares of any class of stock.

•

Completes Quebec Board

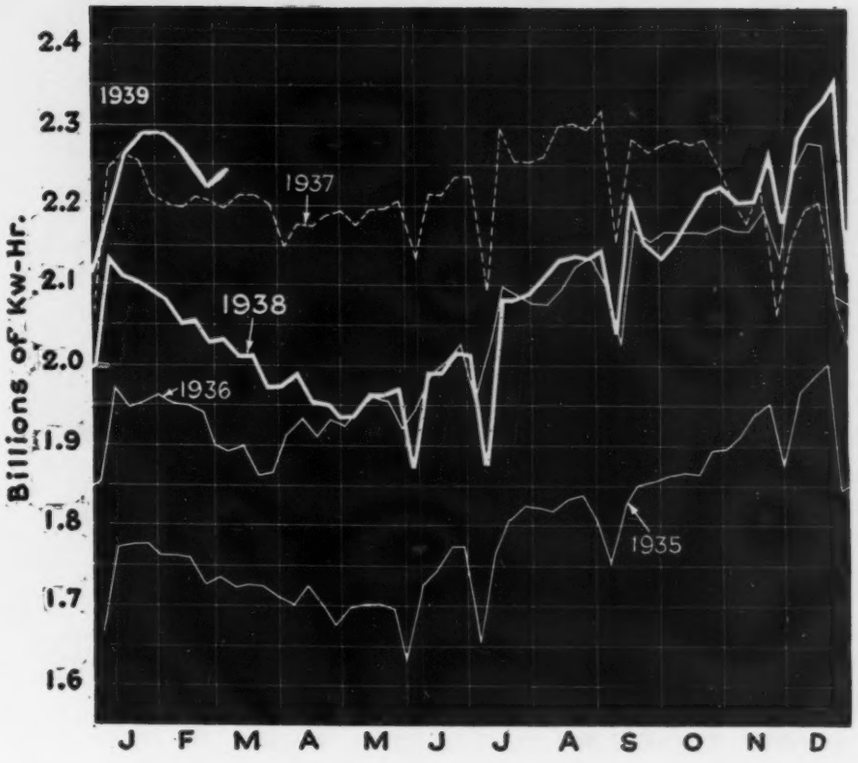
Addition of five new officers to Quebec's National Electricity Syndicate, completing the make-up of the body in charge of the Provincial Government enterprise in state power production, has been announced by Premier Maurice Duplessis. Appointed during a recent Cabinet meeting, the new officers are: P. de Longchamps of Montreal, named board member; George O. Vogan, chief engineer; H. S. Halloway, assistant engineer; R. S. Talbot, inspector, and Bernard Lacoste, secretary.

OutputTurnsUpward, 10.2% Above 1938

Turning upward after the moderate decline in the week that included Washington's Birthday and continuing on the highest level ever recorded for this season, the output of energy by the electric light and power industry during the week ended March 4 rose to 2,244,014,000 kw.-hr., according to the Edison Electric Institute. This was 10.2 per cent more than in the like week of 1938 and 2.0 per cent above 1937.

Both of these figures are larger than in the preceding two weeks. Production is nearer the January peak than at this time in 1937 or 1938.

New England still leads in regional gains, although its percentages have been shrinking, whereas they are being maintained in the Central Industrial and Middle Atlantic areas and they are widening in the Pacific. Comparisons with changes a year ago show gains over 1937 around 7 per cent in the Pacific and Middle Atlantic and about 3 in New England and the South.



Weekly Output, Millions Kw.-Hr.

1939	1938	1937
Mar. 4..2,244	Mar. 5..2,036	Mar. 6..2,200
Feb. 25..2,226	Feb. 26..2,031	Feb. 27..2,207
Feb. 18..2,249	Feb. 19..2,059	Feb. 20..2,212
Feb. 11..2,268	Feb. 12..2,052	Feb. 13..2,200
Feb. 4..2,287	Feb. 5..2,082	Feb. 6..2,201
Jan. 28..2,293	Jan. 29..2,099	Jan. 30..2,215

Per Cent Change from Previous Year

Region	Week Ending Mar. 4	Feb. 25	Feb. 18
New England	+12.2	+13.1	+14.4
Middle Atlantic	+ 8.3	+ 8.1	+ 8.0
Central Industrial	+12.0	+12.1	+11.1
West Central	+ 5.4	+ 3.7	+ 1.4
Southern States	+10.5	+ 7.2	+ 6.8
Rocky Mountain	+ 8.7	+10.0	+ 9.1
Pacific	+ 9.3	+ 7.1	+ 3.6
United States	+10.2	+ 9.6	+ 9.2

Output Gains 10% Over January, '38

Production of electric energy for public use during January totaled 10,430,265,000 kw.-hr., a decrease of 2.1 per cent from December and a gain of 10 per cent over January last year, according to the Federal Power Commission. Output by electrified railways and railroads and other plants which generate principally for their own use amounted to 223,192,000 kw.-hr., making a total production reported to the commission of 10,653,457,000 kw.-hr.

The total capacity of generating plants available for service amounted to approximately 39,097,000 kw. as of January 31, a gain of 253,000 kw. reported during the month of February. This figure includes plants owned by electric railways and railroads, federal and state organizations, as well as that portion of manufacturing plants allocated to production of energy for public use.

Electric utility power plants consumed approximately 3,785,633 net tons of coal in January, of which 3,597,696 tons were bituminous and 187,937 were anthracite, decreases of 2.8 per cent and 5.5 per cent respectively, when compared with the previous month. Production by water power in January amounted to 3,728,748,000 kw.-hr., as against 3,885,324,000 in December.

•

Opposes Power Project

The Kanawha Coal Operators Association and a joint meeting of several chambers of commerce under the auspices of the Bluefield, W. Va., Chamber of Commerce unanimously adopted resolutions condemning what is known as the proposed Bluestone reservoir and hydro-electric power project on the New River. Congress has been asked not to appropriate money for the project and the Governor and Legislature have been requested to look into the project to save the coal industry.

•

Starts Improvement Plan

Iowa Power & Light Co. was granted by a vote of 2,253 to 936 a 25-year franchise in a special election held recently in Oskaloosa. The company will immediately start a $121,334 improvement program.

Power and Lighting Sales Reported by Georgia Power

Power sales of the Georgia Power Company totaled 20,751 kw. in 1938, representing an estimated increase of 45,292,000 kw.-hr. and an annual revenue of $657,734. This was 135 per cent of the quota set.

New lighting business obtained by the lighting sales division amounted to 4,326 jobs, totaling 9,406 kw., with an estimated increase of 16,000,800 kw.-hr. and an annual revenue gain of $457,167. The company reports that the newly gained load was 0.33 cent per kilowatt-hour more profitable, from a revenue standpoint, than 1937 business was.

•

Output in Texas Advances

Electric power consumption in Texas during January was well above that of both the preceding month and the corresponding month last year, according to the University of Texas Bureau of Business Research. Reports from a representative group of Texas power companies indicate a gain in consumption of 3.7 per cent over December and an increase of 7.8 per cent over January last year.

Utility Stocks Off, Bonds Higher in Week

50 Bonds
PRICE TRENDS OF ELECTRIC UTILITY SECURITIES
36 Common Stocks
35 Common Stocks
50 Bonds
85 80 75 70 65 60 55 50 45 40 35 30 25 20 15 10
110 100 90 80
1931 1932 1933 1934 1935 1936 1937 1938 Jan. Feb. Mar. Apr. May June 1939

Electric power and light securities were comparatively steady during the week, although the "Electrical World" stock index dipped 0.1 point to 31.8; a year ago, the index was at 25.4. The bond index showed a slight rise, gaining 0.2 point to 105.2

Files $20,000,000 Issues with Board

Application has been filed by Montreal Light, Heat & Power Consolidated with the Provincial Electricity Board for authority to issue convertible note certificates in the amount of $20,000,000 for the purpose of refunding the company's 3 per cent convertible debentures, maturing July 1, next. The refunding will be through a new issue of ten-year certificates, convertible by the holder at any time within five years into common shares of the company on the basis of 1½ shares for each $50 principal amount.

Authorization is being sought by the company to issue two series of the proposed note certificates, one for an amount of $15,000,000, bearing interest at the rate of 3 per cent, and one for an amount of $5,000,000, bearing interest at the rate of 2¾ per cent.

•

New Regulation Broadens Interlocking Exemptions

SEC has adopted a new set of rules broadening exemptions from the interlocking directorship provisions of the Public Utility Holding Company Act of 1935. The new rules are effective April 1. Under the revision the SEC has provided a new exemption to allow full-time officers and employees of utility holding companies or subsidiaries to act as directors of commercial banking institutions.

All of the exemptions granted by the new rules are subject to the following two limitations:

First, each company is prohibited from having as many as one-half of the members of its board of directors made up of persons having financial connections within the meaning of the Holding Company Act. Under the old rules this prohibition with certain exceptions, is limited to one-third of the members of the directorate.

Second, each company is prohibited from selling its securities either directly or indirectly to a financial institution if an officer or director of the utility during the preceding twelve months has had a financial connection with the purchasing institution.

•

SEC Acts on Pleas Filed by Utilities

Announcement has been made by the SEC that American Water Works & Electric Co., Inc., has filed a declaration in connection with the issuance of $8,000,000 of 3 per cent secured promissory notes to be issued to five banks in New York. Public hearing will be held on March 23. Proceeds from the sale, together with other company funds, will be used to redeem $8,250,000 of presently outstanding notes of the company prior to their maturity.

Other applications follow:

The commission has approved with certain conditions, applications by Engineers Public Service Co. concerning the sale by it of not more than $508,000 of 5½ per cent first and refunding bonds, series A, due 1960, of Western Public Service Co., one of its subsidiaries, and the acquisition by the applicant of 7,000 shares of its own preferred stock.

North Dakota Power & Light Co. has filed a declaration covering the issuance of securities in connection with the proposed merger with Northern Power & Light Co. According to the declaration, the name of the surviving corporation will be changed to Dakota Public Service Co. Both companies are subsidiaries of United Public Utilities Corp.

Declaration by Massachusetts Utilities Associates, a subsidiary of New England Power Association, as amended, has become effective under a ruling by the SEC. It covers issuance of an unsecured note for $4,000,000 at 2½ per cent payable to the First National Bank of Boston, issued in payment of a note to the same bank in similar amount.

The commission has approved, with conditions, an application by the New York State Electric & Gas Corp. of the Associated Gas & Electric System for exemption from filing a declaration in connection with the issue and sale to the Rural Electrification Administration, at face value, of a 2.73 per cent serial note for $500,000 to be secured by $600,000 of the applicant's 4 per cent first mortgage bonds due in 1965.

SEC has issued an order that the Union Electric Power Corp. has ceased to have the status of a holding company under provisions of the Public Utility Holding Company Act.

•

$18,000,000 Issue Offered in Canada

Public offering has been made in Canada of a new issue of $18,000,000 of 20-year 4 per cent first mortgage sinking fund bonds, series A, of Maclaren-Quebec Power Co. The bonds were offered at 98 to yield 4.15 per cent. The new bonds are part of an authorized issue of $20,000,000.

Interest and principal will be payable in Canadian funds only. A sinking fund, starting in 1940, provides for the redemption of $8,000,000 of the total outstanding by Feb. 1, 1959. The purpose of the financing is to retire the company's outstanding first mortgage 5½ per cent bonds.

•

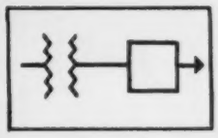
Liquidating Dividend

A 4 per cent liquidating dividend totaling $2,301,750 to debenture holders of the bankrupt Insull Investments, Inc., has been ordered by Federal Judge James H. Wilkerson in district court in Chicago. It is the first payment to the bondholders since 1932. Payment is not expected to be made until after April 1.

Utility Reports (Earnings)

	Net Income 1939	1938
†Commonwealth & Southern & subs.	$12,250,687	$14,619,485
†Dallas Pwr. & Lt.	1,600,636	1,592,921
†Houston Ltg. & Pwr.	2,993,771	2,819,520
†Kansas City Pwr. & Lt.	3,742,467	4,385,363
†Nebraska Pwr.	1,875,440	1,869,179
	1938	1937
*Arkansas Pwr. & Lt.	1,317,440	1,422,070
*Associated Elec. & subs.	1,970,776	1,557,986
*Carolina Pwr. & Lt.	2,504,398	2,564,681
*Duquesne Lt.	9,041,391	10,095,050
*Minnesota Pwr. & Lt.	1,112,327	1,491,537
*NY PA NJ Util. & subs.	4,153,634	4,834,183
*Philadelphia Co. & subs.	4,752,775	7,179,839

†Twelve months ended January 31.
*Twelve months ended December 31.



A single-circuit unit substation without disconnect switches, installed by Coast Counties Gas & Electric Co.

12% Saved in Installed Cost *by Using* a 1000-kva G-E Unit Substation

Coast Counties Gas & Electric Company Installs It Overnight

EVERY claim that General Electric has made since it pioneered the unit-substation idea, in 1931, was met by this interesting installation:

1. Costs less to install: Coast Counties figures a 12 per cent saving in actual cost, installed. Installation labor amounted to only 2 per cent of the cost of the equipment.

2. Saves time in installation: Installed overnight, without interrupting heavy work schedules of construction crews.

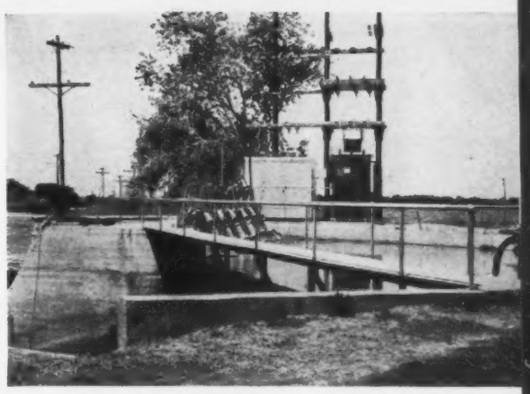
3. Saves on real estate: Over-all dimensions of the unit are 10 feet, 2 inches; by 7 feet, 6 inches; by 13 feet high.

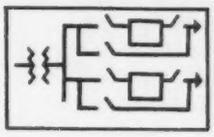
4. Attractive appearance: The company used photographs of the proposed equipment to convince land owners that the installation would not be an eyesore.

5. Saves on system investment: Load growth can be taken care of in small increments by low-cost unit substations which can later be moved complete to other locations.

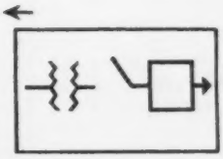
The Coast Counties installation is a single-circuit unit without disconnect switches. Other installations pictured here show a single-circuit unit with disconnect switches, and a multiple-circuit unit with disconnect and by-pass switches.

For that next area to be served, try a G-E unit substation and experience the satisfaction that dozens of users are enjoying. General Electric Company, Schenectady, N. Y.





Multiple-circuit unit substation installed on an Arizona irrigation project



Single-circuit unit substation with disconnect switches, installed by a Southwestern utility

GENERAL ELECTRIC

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Field OPERATING PRACTICES

New ideas and practices in the operation of well-designed constructed and maintained plants and systems

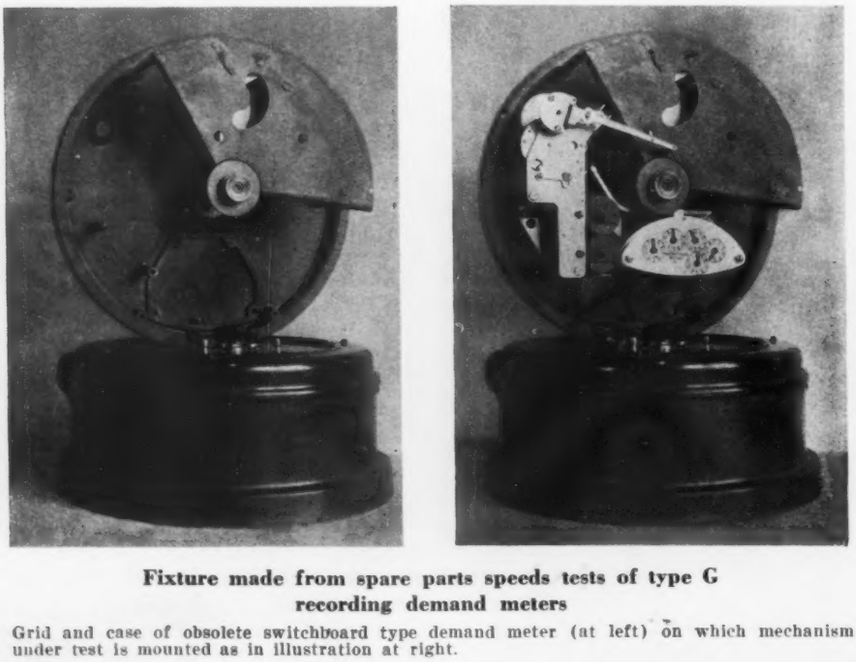
Mounting Jig Speeds Demand Meter Check

By PAUL E. MAYS
Meter Department,
Virginia Public Service Company,
Clifton Forge, Va.

A fixture for adjusting modernized type G recording demand meters for all conditions while the meter mechanism is in the operating position and independent of its case has been developed at the Clifton Forge, Va., meter department of the Virginia Public Service Company. Use of the fixture has reduced the time for revamping or servicing these meters to less than half the time formerly required, at the same time permitting adjustments to be made with a higher degree of accuracy than was previously attained.

The fixture consists of a section of the front plate and chart hub from a discarded meter mounted on the back plate or grid of an obsolete GS-2 switchboard type demand meter. This grid was set up at right angles to the case of the demand meter. A Bakelite insulated plate was put in the top portion of the case and used as a support for a number of binding posts, switches and a reactor.

Complete arrangement offers a mechanical support for the meter operating mechanism, the coils of which are connected to binding posts on the insulated plate below. Cut-away portions of the grid permit access to the operating coils and their adjustments from the back as well as from the side and top. Switches in the case of the fixture operate the advancing coil, the return coil and also permit getting 10 per cent under-voltage and 10 per cent over-voltage.



Fixture made from spare parts speeds tests of type G recording demand meters

Grid and case of obsolete switchboard type demand meter (at left) on which mechanism under test is mounted as in illustration at right.

It is found that after proper adjustments the mechanism can be transferred to its case and will give very satisfactory performance. In order to locate quickly and accurately the mechanism in the case so that the stylus will follow the arc of the chart and the hub can be located centrally with respect to the case, an accurately made template for locating these parts was obtained from the manufacturer.

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That Old Meter Should Be Retired

By HAROLD H. BROWN
Iowa Electric Light & Power Company, Cedar Rapids *

Replacement of an old meter with a new one is economically justified when the value of energy that gets through the old meter without registration is equal to the fixed charges on the new meter—assuming that the new one will register all the energy that goes through it. However, there may be other reasons for old meter replacement, entirely apart from accuracy of energy measurement.

Assume that a new meter, ordinary house type, costs $9 installed. Interest and depreciation of 7 and 4 per cent respectively would make the annual charge on this meter $1, plus something more for taxes. Revenue from unmetered energy would be at the lowest rate step, say 2½ cents per kilowatt-hour. Therefore the meter must fail to register 40 kw.-hr. per year before it can be replaced economically.

Lost registration on an old meter mostly occurs during overload peri-

* Adapted from paper to Iowa State College Electric Meter Conference.

How a Voltage Problem Was Solved at a Saving

A NEW ENGLAND UTILITY REPORTS ITS EXPERIENCE WITH PYRANOL CAPACITORS

The Conditions

IN 1937, the Derry Electric Company, Derry, N. H., operated by the New Hampshire Gas & Electric Company, found poor voltage conditions developing on several of its circuits because of the addition of thousands of appliances and the resultant increased wattless current.

This company purchased energy subject to penalties for power-factor below 80 per cent, and these penalties approached $250 a month on one representative load of about 750 kw.

The Answer

A number of remedies suggested themselves, but failed to offer a complete solution.

A careful survey showed, however, that voltage and power-factor could be improved simultaneously by the **correct application of capacitors on the feeders themselves.** A total of 225 kva of G-E Pyranol capacitor units, ranging in size from 10-kva to 60-kva, was installed on the two rural circuits and one power circuit involved. Installed cost of the capacitors was $2200.

The Profitable Results

1. System power-factor was raised from about 60 per cent to 85 per cent, resulting in a saving of $250 per month in the cost of power.

2. Voltage was improved to the point where complaints about voltage were avoided.

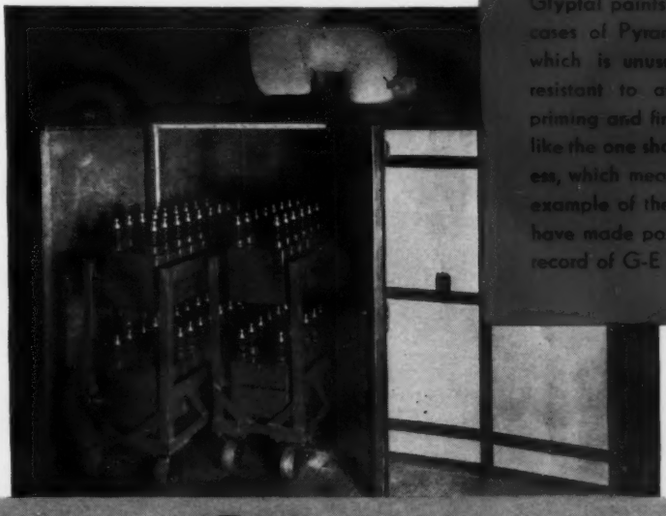
W. H. Allen, Superintendent of Distribution and Transmission, the New Hampshire Gas & Electric Co., Says

"This problem of wattless currents can no longer be restricted to industrial loads, for the magnetizing current required by the ever-increasing residential load, with its countless small motors, is fast becoming a problem.

"Our experience in applying small capacitor units carefully distributed has not only been translated into improved power-factor, but voltage regulation and voltage gradient have been bettered unbelievably. Best of all, regulation remains constant at both full-load and light-load periods."

Opportunities on Your System

It will pay you to consider applying Pyranol capacitors on your system to release capacity of overloaded substations and feeders and to improve voltage conditions. Ask your G-E representative for complete information or write for Bulletin GEA-2746, "Pyranol Capacitors for Central Station Applications." Address General Electric, Dept. 6—201, Schenectady, N. Y.



The G-E ten-million-volt lightning demonstration at the New World's Fair uses 102 Pyranol capacitors, each rated 100,000 volts

HOW RELIABILITY IS BUILT INTO G-E PYRANOL CAPACITORS

Glyptal paints applied on the tin-plated steel cases of Pyranol capacitors provide a finish which is unusually tough and exceptionally resistant to abrasion and weathering. Both priming and finishing coats are baked in ovens like the one shown at the left. This baking process, which means longer life for the finish, is an example of the manufacturing methods which have made possible the remarkable operating record of G-E Pyranol capacitors.

GENERAL ELECTRIC

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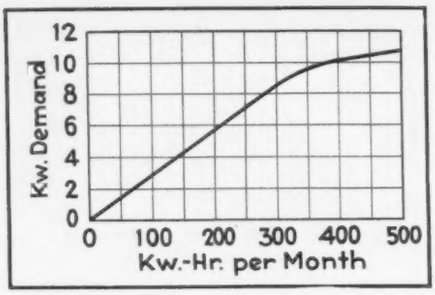
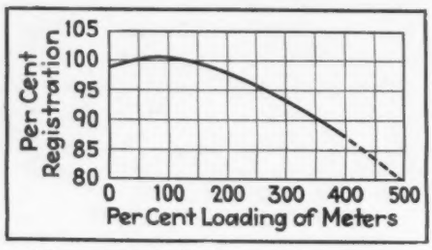


Relates consumption and demand of residence loads



Characteristic loading and accuracy curve for an obsolete type of meter

ods. How much of the total registration of an old meter is made at times when the meter is overloaded? How much are the errors at different overloads? The errors may readily be determined from curves of average meter performance. In a specific case, however, the only exact information from which to derive proportions of registration during overload periods is the record of monthly readings. However, from study of residence loads it is possible to set up an empirical average statement of the relationships between energy consumed and maximum demand of a residence customer. These relationships appear in one of the accompanying curves.

From the monthly consumption the maximum demand can be determined by reference to the curve. Let us assume that one-half of the energy is taken at the maximum demand and all other energy at points on the meter's curve which will average correct registration. If a consumer uses 100 kw.-hr. per month he will take 50 kw.-hr. at the maximum demand rate of 2,900 watts and the rest at lower demands which the meter will register correctly. The meter will (assuming a 5-amp., two-wire, 115-volt meter) operate at 505 per cent of its rating while registering these 50 kw.-hr. According to a rather typical characteristic curve for an obsolete type of meter, as appears in an accompanying graph, the meter will be about 20 per cent slow or thus fail to register about 10 kw.-hr. on this consumer and a meter change is justified.

The figures used here, except for the curve of relationship between demand and consumption, may not be taken as actual for any situation.

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Special Phone Desk Speeds Service Calls

By LOUIS STOECKER
Supervisor of Service to Customers
Public Service Electric & Gas Company,
Newark, N. J.

Combination of a rotary file with a specially designed telephone table for handling customers' service calls at the Jersey City commercial office of Public Service Electric & Gas Company has eliminated a separate file installation and the need for direct wire communication between the file and table, thereby speeding the handling of calls for information.

A six-position telephone table installation formerly used at Jersey City included a pending order file with two file clerks in an adjacent location. With the present installation six men handle both activities. This permits telephone calls being handled more quickly since information does not have to be relayed by the file clerk to the telephone clerk and from him to the customer. During the regular slack periods of the day there is ample opportunity for the men at the table to help maintain the file.

The table, shown, is provided with type 100 A lamp and key cabinets, of six lines each, mounted flush with the desk surface. There are four groups of three cabinets each, or eighteen lines; two of the groups are single cabinets for operation of one man each and two are three double cabinets each for operation from either side. The lines are multiplied throughout all cabinets so that operators can pick up calls at any one of the six positions. Nine of the eighteen lines, or 1½ lines per man, are reserved for incoming calls; each man has an outgoing line and the balance is used for interoffice calls.

Four clerks man the table regularly. One is responsible for the files and answers calls only when the demand requires. This is when sporadic peaks occur and at such times as lengthy peaks are reached beyond the capacity of the five other positions. The three other men are responsible for the handling of calls, but assist in filing at off-peak periods, under the supervision of the file clerk.

In addition to the six-position telephone table at Jersey City there are eight four-position and two two-position tables in operation on the system, besides a sixteen-position table in the Newark commercial office.

•

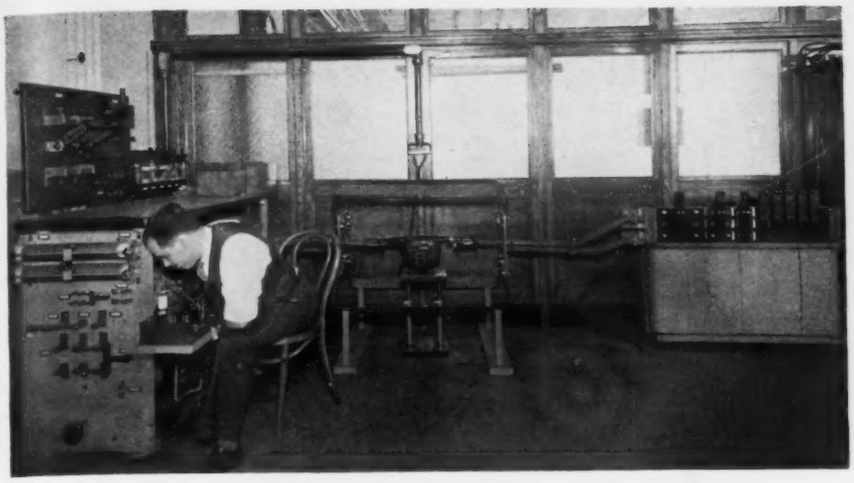
Uniform Field for "C.T." Measurements

By RUSSELL C. GHEN
Boston Edison Laboratory

A requisite of accurate ratio and phase-angle measurements of current transformers is a uniform magnetic field with respect to the core as produced by the primary circuit current. This is particularly true of transformers rated above 1,000 amp.

The National Bureau of Standards

Rotary file on phone table speeds handling of customers' service calls
The drum is equipped with six compartments for 3x5-in. forms and twelve compartments for 5x8-in. forms. Table has eighteen-line capacity.



Bus layout for uniform field in current transformer tests

made an extensive investigation of the variations in ratio and phase-angle measurements of current transformers caused by the changes in the geometrical configuration of their primary circuit. From this it was concluded that a symmetrical location of the primary circuit with respect to the core is generally best for all transformers. (See "Research Paper RP-775," April, 1935.)

Arrangement of the primary current circuit, the current controls and the burden switches as used by the Boston Edison laboratory is shown herewith.

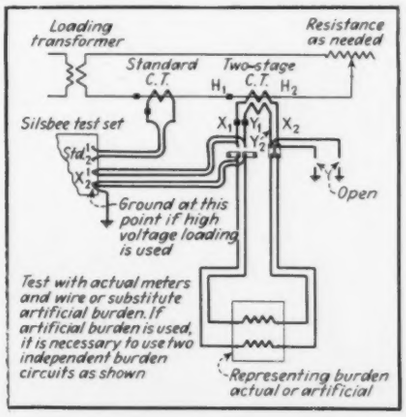
The primary circuit consists of copper buses which connect the supply transformer, the transformer under test and the primary shunts in series. This circuit is so arranged that two copper buses carrying current in opposite directions are face to face and close together throughout the entire circuit except where the transformer under test is connected. Here the center portion of the copper bus (called the inner conductor) carrying current in one direction is replaced by the primary of the transformer under test. The remaining ends of the inner conductor are adjustable to provide for testing various size transformers. An adjustable brass stand is used to support the transformer.

The copper bus (called the return lead) carrying current in the opposite direction is close to the inner conductor up to two points 20 in. from the center of the transformer being tested. At each of these points the return lead is connected to a copper plate whose flat surface is perpendicular to the inner conductor. The circuit is completed by four copper buses symmetrically arranged 20 in. from the inner conductor connecting these plates together, thus creating a condition of uniform flux at the center where the transformer is located.

•

Set-up for Testing Two-Stage C.T.

Use of two-stage current transformers is not widespread and instrument sets especially designed for testing them are not generally available. A system of connections which allows testing of these transformers with standard equipment has been developed by the American Gas & Electric Company. (The test set used is a standard Leeds & Northrup Silsbee set.) The accompanying drawing is from the meter standards of this company.



Test two-stage current transformers with standard instruments

Auxiliary test leads should be of comparatively low resistance and should be paralleled only at terminals of test set. Thorough inspection should be made on service tests to assure isolation of secondary and tertiary circuits. This is easily checked by removing Y circuit from set and ringing between X and Y.

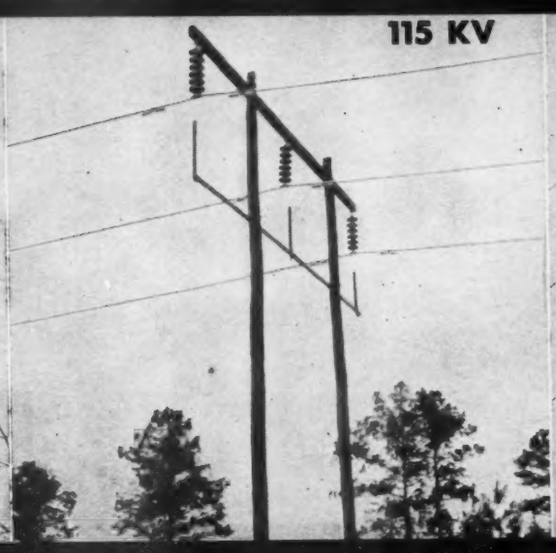
•

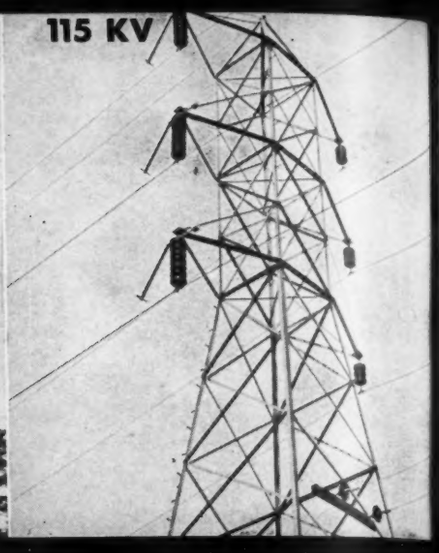
Treat Ground Line, Eliminate Termites

Ground-line treatment of 420 cedar poles that were infested with termites at the Riverhead, Long Island, transmitting station of R.C.A. Communications, Inc., appears to have eliminated this source of pole destruction effectively. When upward of 60 of these poles were removed during major construction changes in 1936 (three years after treatment) no termites were observed. A greater part of the sapwood of these poles had been destroyed prior to the time of treatment, but there were a number of poles on which sapwood around one-third of the circumference retained its original color and some of its original strength. Inspection made as recently as September, 1938, showed that this had not changed, or at most very little, for the worse since application of the chemicals.

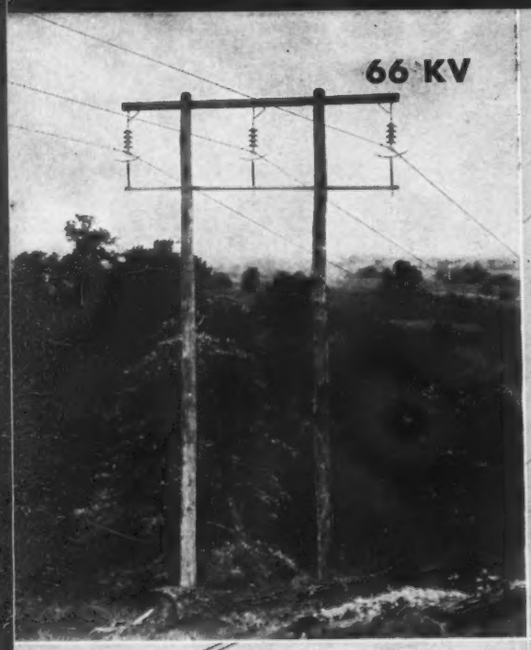
The work of ground-line treatment was done by a crew of local men under the supervision of Sanders-Durling Entomological Service, New York City. A funnel-shaped excavation 12 in. wide at the surface and tapering to nothing at 30 in. depth was made around 60-ft. poles and about 20 in. deep around 16-ft. poles. The exposed sapwood below the ground line was hacked with a hatchet and chips broken partly away from the pole, yet left attached at lower end. The series of funnels so formed insured intimate application of the powders directly to the exposed termite channels and partly decayed wood. Arsenical salts whose solubility is controlled by the addition of alkalies were applied against the pole alternately to within 6 in. of the surface as the excavation was backfilled.

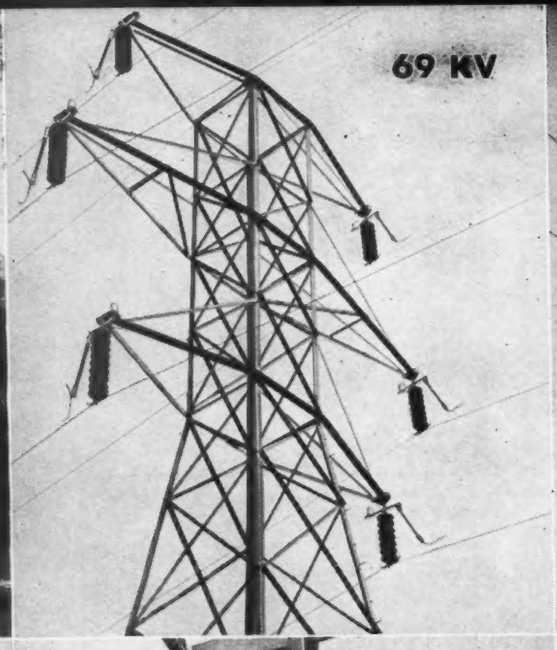
Protection against rot fungus is a noticeable by-product of the treatment and a valuable one, it is said, since semi-rooted wood is ideal termite food and a continuous progression of fungus growth precedes the actual termite work toward and into the heartwood.

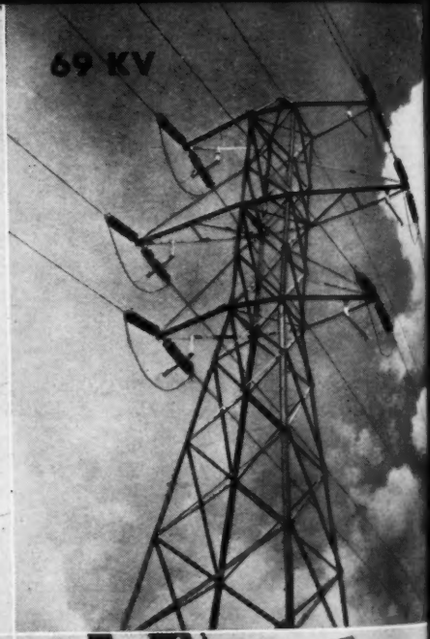


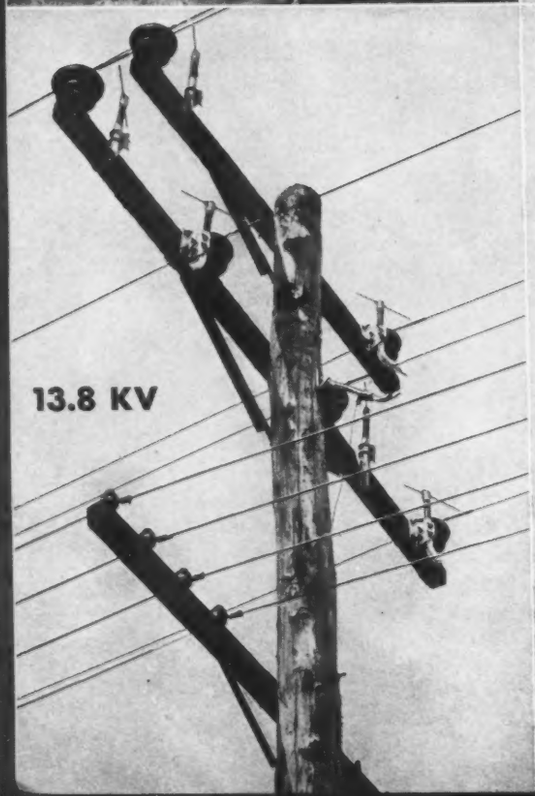


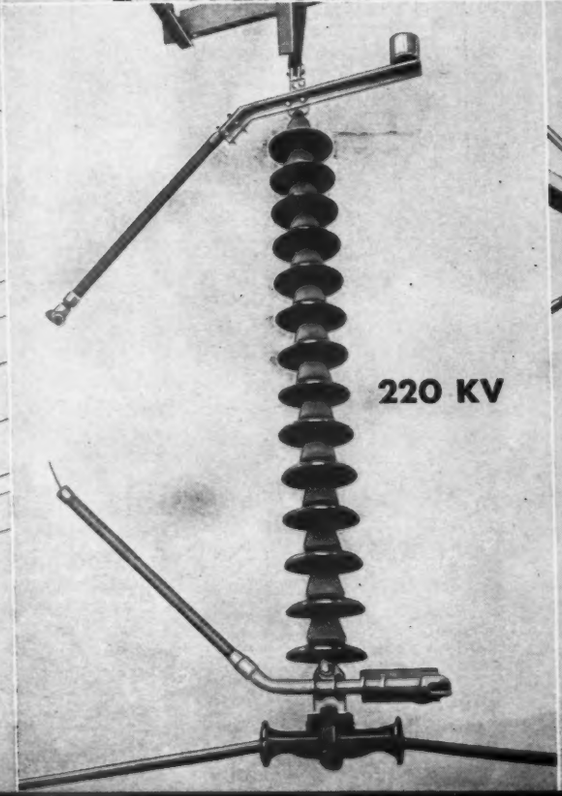
PREPARE NOW FOR THE

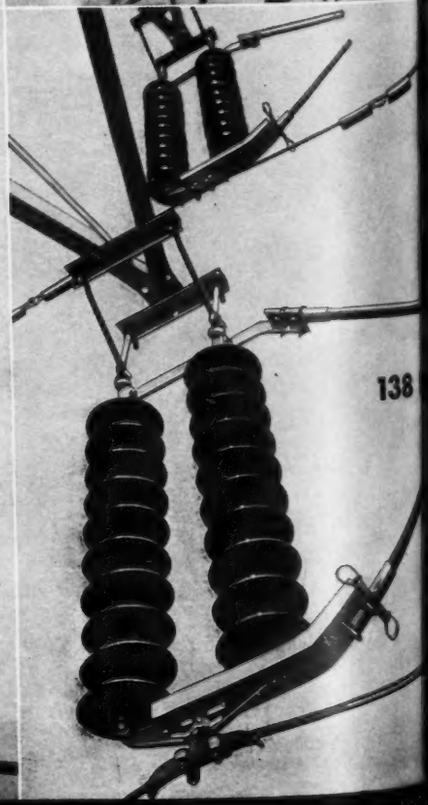












Industrial ELECTRIFICATION

New ideas and practices in industrial electrification as presented by industrial, consulting and power sales engineers

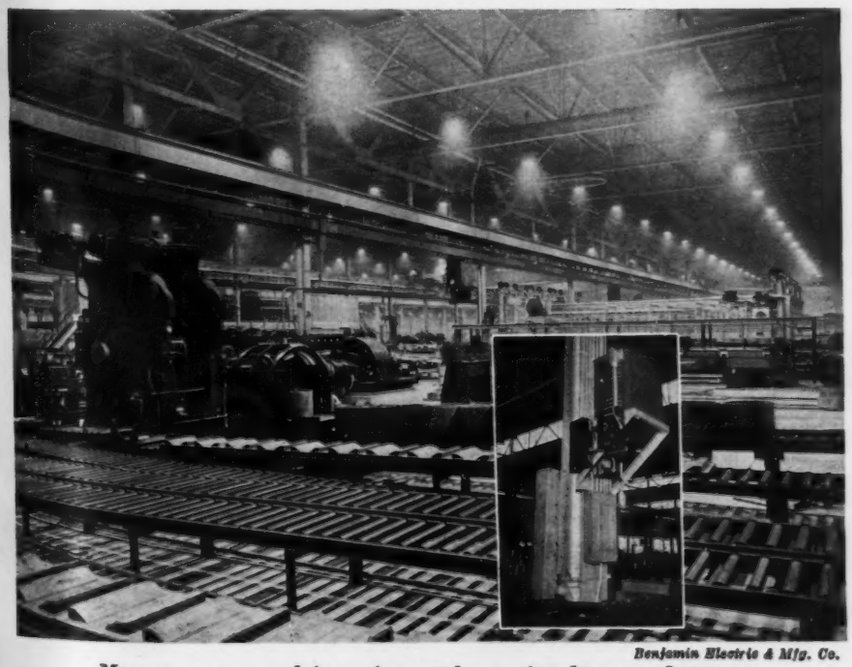
Brass Rolling Mill Uses 20 Ft.-Candles

Combination mercury-incandescent lighting at the new continuous rolling mill of the Bridgeport Brass Company, Bridgeport, Conn., has been designed to give an illumination intensity of 19 to 20 ft.-candles throughout the plant. This illumination level was selected to provide a pleasant working atmosphere, promote safety and enhance production quality and speed.

Rather than combine mercury vapor and incandescent lamps in a single fixture, excellent color characteristics have been obtained by alternating a 400-watt mercury lamp and a 750-watt incandescent unit on 22x25-ft. centers 33 to 35 ft. from the mill floor.

Distribution voltage of 460 volts, three phase is stepped down to lighting voltage of 120 volts in column-mounted 25-kva. dry-type lighting transformers strategically located. There are fifteen of these transformers in the mill properly connected to the distribution system through 60-amp. service switches. A typical arrangement is shown herewith.

To minimize the problem of keeping the high-bay reflectors clean in the contaminated atmosphere of a rolling mill, clear-glass cover plates have been installed on the Benjamin reflectors. The cover plates are easily cleaned from overhead crane cab.



Benjamin Electric & Mfg. Co.

Mercury vapor and incandescent lamps in alternate fixtures light new brass rolling mill

Dry-type transformers (insert) step 460-volt a.c. distribution to 120 volts for lighting

Reduce Load Peaks* by Use of Batteries

Use of mine-gathering motors powered by storage batteries that are charged at night from the same synchronous motor-generator set that supplies haulage motors during the day has contributed to the economy of power use at the Ramage, W. Va., mines of the Spruce River Coal Company. The effect of battery charging and division of coal cutting load between day and night shifts has held down peak demand and the synchronous motor-generator set has improved power factor.

Principal connected loads at this mine during the day shift include (1) a.c. tipple motors, (2) two a.c. coal cutting machines and (3) the 100-kw. motor-generator set supplying 250 volts d.c. to two 8-ton haulage motors. The night load consists of (1) three a.c. coal cutters and (2) the 100-kw. motor-generator now supplying d.c. power at slightly under 200 volts for charging the gathering motor batteries.

Variation of the generator characteristics of the synchronous motor-generator set to deliver 250 volts for trolley locomotive operation during the day and a lower voltage at night for battery charging was accomplished by the simple expedient of putting a carefully calibrated resistor across the series field of the compound wound generator through a knife switch. The arrangement makes a double-duty unit of the motor-generator set and insures maximum efficiency for each duty.

Flattening of the load curve by the

* Abstract of a report appearing in *Storage Battery Power.*

methods described has made it possible to employ a 200-kw. load limiter which breaks the circuit to the motor-generator if the limit is exceeded for more than fifteen minutes.

•

Supplying Power to Single-Phase Welders

Single-phase contact welders* are disturbing elements in any three-phase system to which they may be connected. The single-phase loads imposed may range from a few kva. for a few cycles per weld up to several thousand kva. for five to ten seconds per weld. Power factor is rarely better than 80 per cent lagging and may be as low as 30 per cent lagging. Compared with the peaks imposed the energy consumed is negligible.

Where energy is purchased from a utility company, voltage fluctuations may be present not only in the plant but in the entire adjacent area. To eliminate such disturbances it is necessary in numerous instances to install motor-generators to serve as phase converters for supplying single-phase welding loads. Not every single-phase welder requires a motor-generator, but in some installations, principally in connection with butt, flash, spot and seam welders, use of motor-generators is unavoidable.

Long welding cycle

Fabrication of axle housings† by butt welding, for example, requires from 6,000 to 9,000 amp. at 350 to 400 volts, single phase. The welding time cycle ranges from five to eight seconds. Experience indicates that single-phase welding generators for this application should be designed so that repeated peak loads are not greatly in excess of the normal continuous rating. Generators can be driven by synchronous motors. Where it is desired to reduce line peaks or the rate of change of line input, wound-rotor induction motors with flywheels and fixed slip resistance are used.

Load periods for large flash welders usually range from ten to fifteen seconds. During the early part of the cycle the load is light. As the heating extends over the entire area of the weld, the load rises sharply to a maximum and fluctuates violently. A single-phase generator which supplies a flash welder can be regulated in many cases merely by using a field forcing contactor which is interlocked with the main contactor. By this means the voltage variations can be limited to about 3 per cent. For most applications a synchronous motor is the preferred drive.

Spot welders usually operate in conjunction with automatic timers which control duration of the power impulses over a range of from one cycle to 25 cycles. A spot welder of modest size may draw single-phase peaks of 800 kva. at 0.30 power factor and consume hardly more than 20 kw.-hr. per hour. For installations where the duration of the load impulses are 15 cycles or less it has been found satisfactory to operate without regulating devices of any kind. For such an installation the generator is designed for continuous capacity about equal to the maximum peak kva. required by the welder.

The root-mean-square load on a motor-generator supplying a spot welder is moderate. The preferred drive is a squirrel-cage induction motor, since slip of the induction motor will permit utilization of the kinetic energy of the set to equalize line peaks.

The load of a seam welder consists of succession of short impulses repeated at regular intervals under the control of an electronic timer. A generator for supplying a seam welder requires a larger driving motor than a spot welder because of the higher average load. A synchronous motor provides the most satisfactory drive. A generator voltage regulator is helpful in maintaining stable conditions.

•

Phase Changer Has Compensator Feature

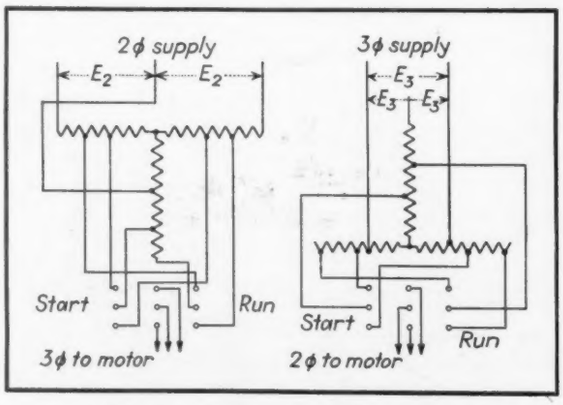
Specially designed auto-phase-changing transformers provided with taps from which low voltage can be taken for motor starting have solved changeover problems for a number of plants in the Elizabeth, N. J., area that have two-phase service.

Looking to the eventual conversion of all plant electrical equipment for three-phase operation, new equipment for these plants was generally purchased three phase. Use of the special auto-phase-changing transformer allowed this equipment to be served three phase from the existing two-phase service and the provision of the voltage taps with an appropriate switching scheme allowed the three-phase machines to be started at reduced voltage without using a compensator. The saving was considerable.

With the eventual change in plant service from two to three phase the phase changers could be reversed and used to supply whatever two-phase machines were yet unconverted to service on three phase. Finally, when all equipment was changed over the units (which are of the dry type) can still be used for motor starting as a compensator.

Iron losses of the phase changers range from 30 watts for 5-kva. units to 300 watts for 100-kva. units and copper losses from 40 to 270 watts for the same range of sizes. Cost of the units varies from around $8 per kva. to about $3 per kva.

Design of the phase-changer compensator was worked out by the American Transformer Company in co-operation with the industrial engineers concerned and the power representative of the utility company serving the Elizabeth, N. J., area.



Combined auto-phase-changing transformer and starting compensator

Taps on the phase-changing transformer provide low voltage for motor starting on both two and three phase.

* From a paper by R. H. Wright, Westinghouse Electric & Manufacturing Company, before winter convention of A.I.E.E.

† See also ELECTRICAL WORLD, December 17, 1938, page 58.

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before you need it

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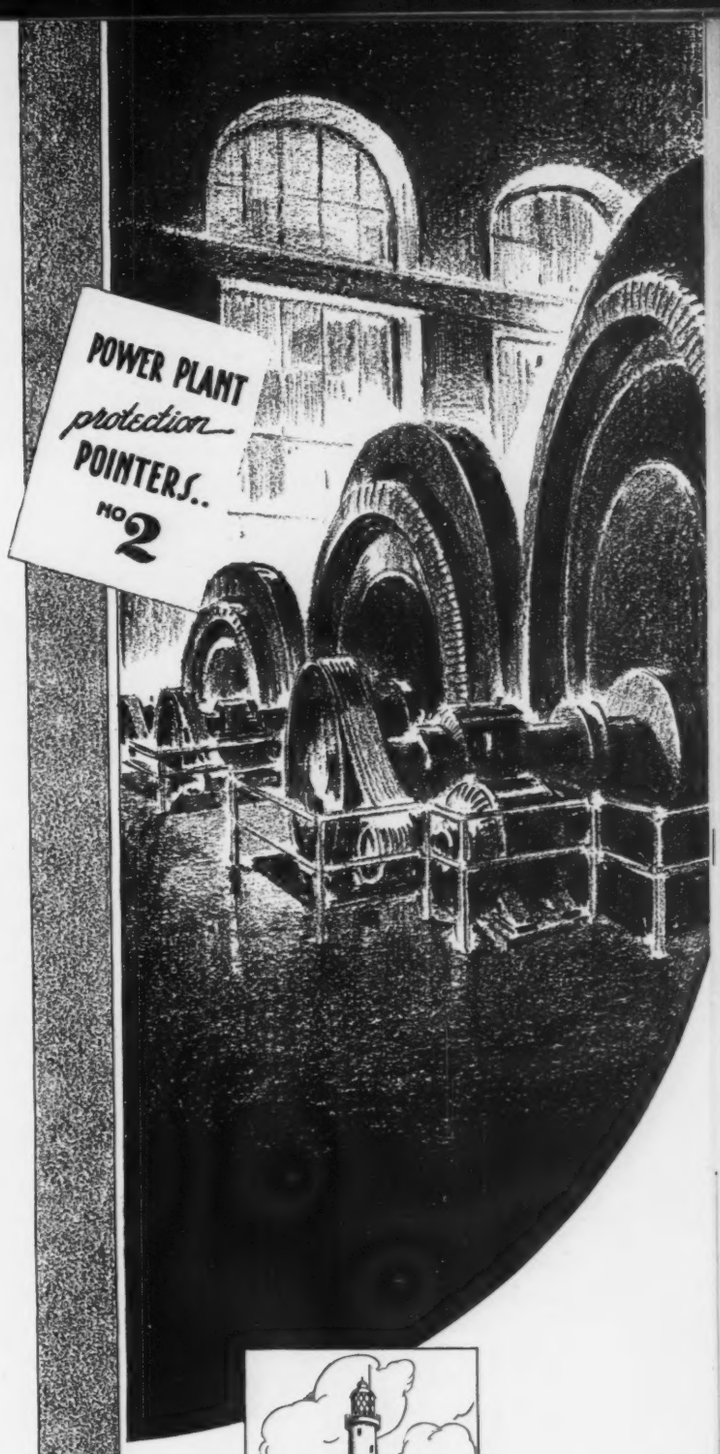

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New ENGINEERING IDEAS

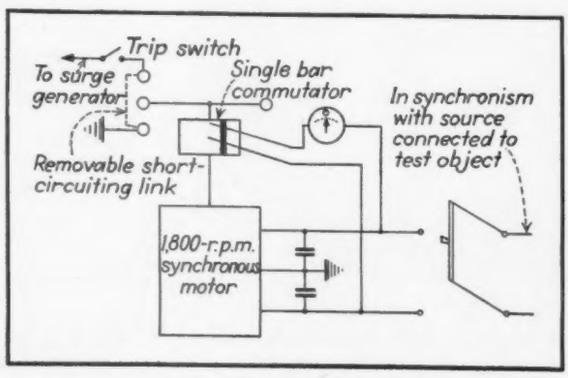
Discoveries, proposals and developments by electrical engineers and scientists in the field, the factory and the laboratory

Trip Surge Generator at Any Wave Point

By JOHN R. GASTON
Manager Industrial Transformer Division
American Transformer Company,
Newark, N. J.

A simple synchronizing scheme incorporated in the design of the new surge generator of the American Transformer Company allows the 1,200,000-volt surge from the generator to be applied to the apparatus under test at any desired point on the 60-cycle wave. The essential parts of the synchronizing apparatus are shown in the accompanying sketch.

A single-phase synchronous motor operating in synchronism with the apparatus being tested drives a blade revolving between spheres of a sphere gap. With the motor operating, as it does, at a synchronous speed of 1,800 r.p.m. a blade passes between the spheres once every cycle. By slipping poles on the synchronous drive motor and adjusting the angular position of the blade on its shaft the point on the cycle at which the blade passes through the gap may be selected. Visual indication of the magnitude of the voltage and, more important, its polarity at this instant is given on a center zero voltmeter which is connected across the motor supply line once every revolution by a single-bar commutator, the position of which is properly adjusted with respect to the blade. In operation the blade drive motor is carefully synchronized with the 60-cycle source with the trip switch open. Upon closing the trip switch the first blade passing between the spheres of the gap trips the surge. The synchronizing device may be made inoperative by short-circuiting the sphere gap.



Synchronizing scheme trips high-voltage test surge at any point on 60-cycle wave

•

Gas-Filled Cable Uses Low Pressure

Recent development of a low-gas-pressure cable which requires less insulation for a given conductor size than the solid type construction was announced by General Electric Company* at the midwinter convention of the A.I.E.E. As a result of this design gas-filled cables of a higher rating can be substituted for solid types in existing duct systems without enlargement.

General construction of the new cable is quite similar to that of oil-filled cables which are now widely used. The principal difference is that instead of being filled with gas-free oil the channel spaces are drained before the cable leaves the factory and the cable system is filled with a neutral gas, nitrogen, under moderate pressure (10-15 lb. per sq.in.). In line with its function of filling the gap between the solid-type and the oil-filled construction, particularly in the voltage range from 10 kv. to 35 kv., its operating voltage stress in volts per mil is not as high as that for oil-filled cable, but is considerably higher than that of the conventional solid type impregnated paper insulated cable.

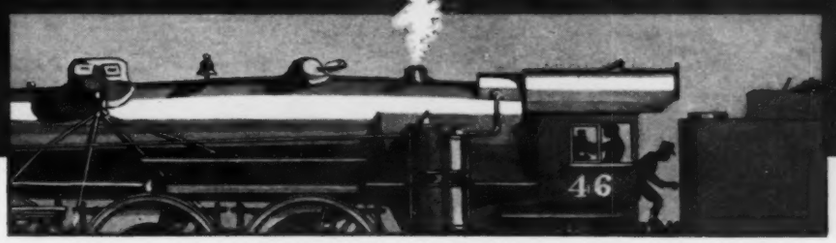
The three gas channels through the

Low gas pressure cable

Cross-section of three-conductor gas-filled 15-kv. cable 800,000 circ.mil. This is of the type and rating now being used by the Consolidated Edison Company of New York and the Yonkers Electric Light & Power Company.

* See A.I.E.E. paper "Low Gas Pressure Cable," by G. B. Shanklin, presented at winter convention.

SAFETY VALVES



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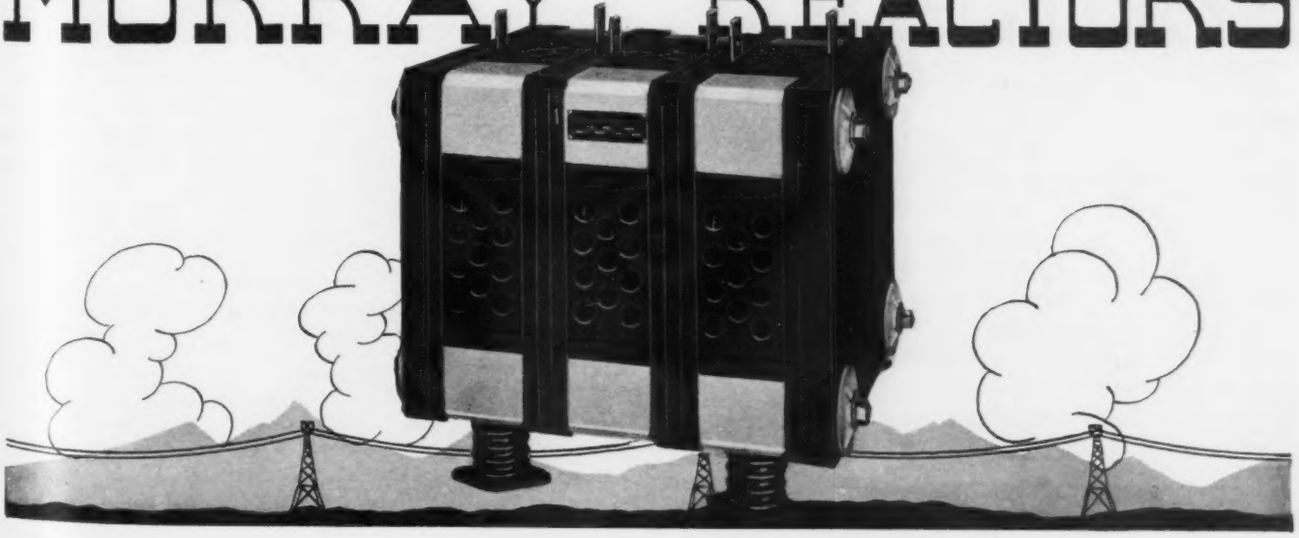
MURRAY REACTORS



cable are designed to allow the dry inert nitrogen gas to come in direct contact with and saturate the impregnated paper insulation, giving assurance of maintaining pressure through the whole cable cross-section with minimum time lag during the temperature and pressure variations. Further, the longitudinal gas-feed channels are necessary to facilitate control of uniform gas pressure along the cable length in service.

The cable is said by the manufacturer to be almost as easy to handle in the field as is solid type cable and splices are simple. The adjustment of gas pressure can be handled economically by gas reservoirs when conditions require them. An alarm system can be installed to detect gas leakage.

During the past summer the Consolidated Edison Company of New York and the Yonkers Electric Light & Power Company have made two trial installations of 15-kv. low-gas-pressure cable. The first, consisting of a single three-conductor cable circuit 10,000 ft. in length, was installed in Yonkers during August, 1938. The second, consisting of two parallel circuits of three-conductor cable, each 5,000 ft. in length, was installed a month later in the downtown district of New York City.

•

Annunciator System for Central Station

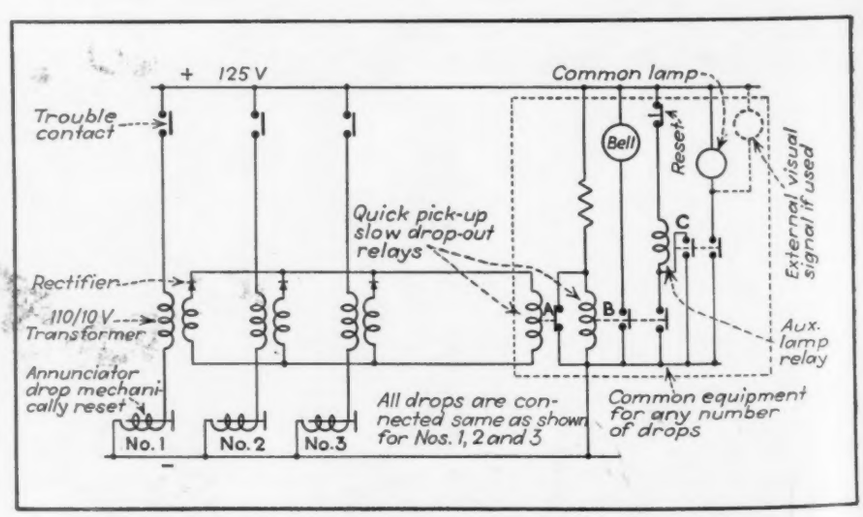
By E. C. SCHURCH
Denver, Colo.

An annunciator system devised for power plant use provides both an audible and visual signal, upon drop operation, without using contacts to clear the drop from the common audible and visual signal relays. The arrangement greatly simplifies the annunciator system and reduces contact maintenance.

The scheme requires d.c. for its operation. This can be taken from the station battery or a copper-oxide rectifier. Referring to the diagram, when a trouble contact closes, the surge of current through the drop coil and transformer induces a current impulse in the transformer secondary, causing relay *A* to pick up momentarily and in turn pick up relay *B* to operate the bell for a time. Relay *C* also picks up and seals in keeping the common lamp and visual signal unit lighted until the reset button is operated.

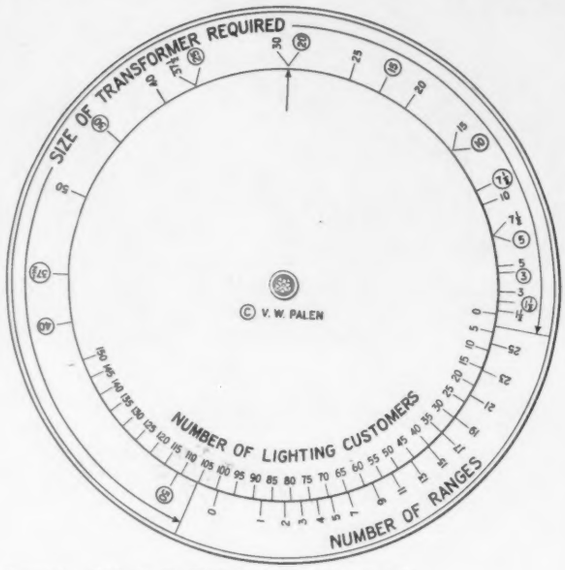
Relays *A* and *B* are of the quick pick-up, slow drop-out type. After the surge of current following the closing of the trouble contact has subsided the impedance of the transformer drops to its d.c. resistance value, the annunciator drop coil operates and the current in the transformer secondary drops to zero. The copper oxide rectifier in the transformer secondary circuit prevents wasting energy through the group of secondaries in parallel and also prevents operation of the alarm on the reverse impulse when a trouble contact opens. This scheme allows operation of any drop without interference with any other drop, either when several drops are operated simultaneously or in sequence. No drop contracts are required anywhere in the arrangement.

The scheme illustrated is applicable to standard mechanical drop type annunciators. The common lamp may be mounted inside the annunciator case and serves to direct the operator's attention to the particular annunciator on which the trouble is registered, in case there are several on the same switchboard. Drop targets may be held in the operated position by a mechanical latch with a manual reset, so that opening of the trouble contacts will not cancel the annunciation. The drops cannot be reset as long as the trouble contacts remain reclosed.



Annunciator system for central station has simplified design

Picks Transformer for Combination Loads

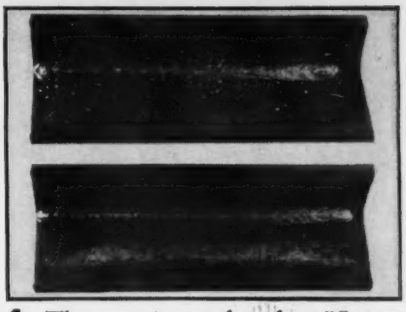


Copyright, 1938, by V. W. Palen (all rights reserved)

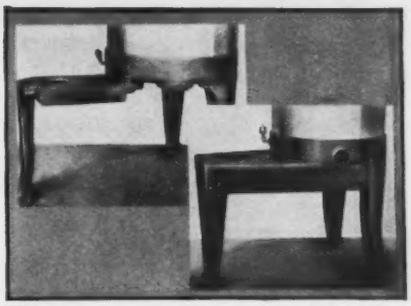
This calculator is designed to determine the proper transformer size to serve any combination of ranges and lighting customers for either 100 or 150 per cent transformer loading. It is based on a demand of 300 watts for lighting customers and a range demand varying on a hyperbolic curve from 3.6 kw. for one range to a constant value of 1.1 kw. for 18 to 25 ranges. Uncircled transformer sizes are based on 100 per cent loading, circled 150 per cent loading, according to V. W. Palen, Northern States Power Company, Eau Claire, Wis.

HOW WOULD YOU WELD IT?

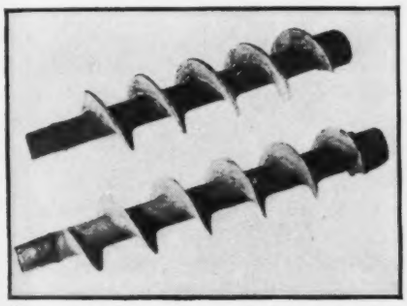
1. Arc welding boosted production of these attic ventilator frames 150%. Mild steel pipe arms are welded to cast iron feet and hub. How would you arc weld it?



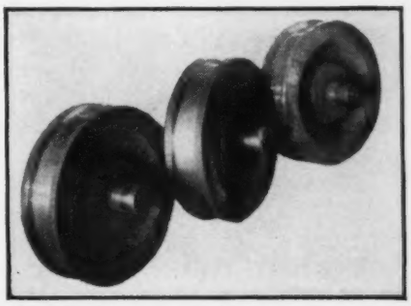
4. These specimens show how "Spatter Film" lessens the tendency of weld spatter to stick, cutting cleaning time 20% to 50%. How is "Spatter Film" used?



7. This potato peeler stand was redesigned for welded steel construction at a saving of $16.06 each. How would you start making changeovers such as this?

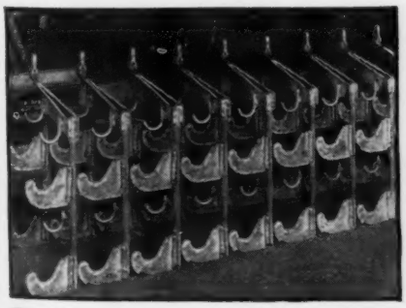


2. The face and rim of elevator stoker screw flights such as this become worn, lessening their efficiency. They can be reclaimed—made better than new. How?



5. These $140 crane wheels were reclaimed by arc welding at a saving of $110 each (including machining). Flanges were built up ½-inch. What is the procedure?

8. Four of these wheelbarrow stamping dies were reclaimed at a cost of $300 each saving $4800. What welding procedure should be used for a job like this?



3. These racks are used for storage of auto parts. Brass is used where machined surfaces rest. The remainder is steel. How would you build a structure such as this?

6. The cast iron arm of a circular shear was cracked and repaired, saving $30. How would you weld it? If the weld had to be machined how would you weld it?

9. You can get any TYPE of arc and any AMPERAGE with the new *"Shield-Arc."* How would you set it for an overhead job? It tells you right on the "Job Selector."

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New ideas and practices in selling electrical equipment and service to commercial and domestic customers

Fry Kettles Foil Isolated Plant

When a customer threatens to install his own electric plant a potent argument of the power salesman is the fact that, once installed, the isolated plant sets a frequently bothersome limitation on the use of electricity. Without adding to his plant, the customer can use just so much power and no more. This argument is particularly cogent in regard to the Diesel engine, which is characteristically incapable of operating under sustained overload. But a better way than argument to get the point across is to start the customer's load to growing, when it will quickly become apparent to him that an isolated power supply would have a hard time keeping up. In the case of customers using commercial electric cooking, the fry kettle is an effective tool for cultivating load growth. For instance:

A large retail and wholesale fish market in a Middle Western city was about to be moved to a new location. The proprietor had announced that he intended to have his own power supply in the new place and it was apparent from his tone that he meant what he said. He. was approached with the idea of adding a prepared sea food department to his store and an offer was made to him to install electric fry kettles on a trial basis. Rather belligerently, he responded to the offer by a virtual challenge to fry 400 pounds of fish for a party he was giving. The electric kettles did the job beautifully and they were put into service in the new store on the trial plan. His fried sea food business expanded rapidly and today the customer is using five electric kettles and is thinking about adding more.

Pleased with the increasing profit attributable to the kettles, the owner quickly recognized that if he installed the engine he had figured on he would set a definite limit on the number of kettles he could use. Furthermore, he could readily see that the engine that would now be required would cost more than the one he had first contemplated because he has added kettles from time to time as increased business has demanded them.

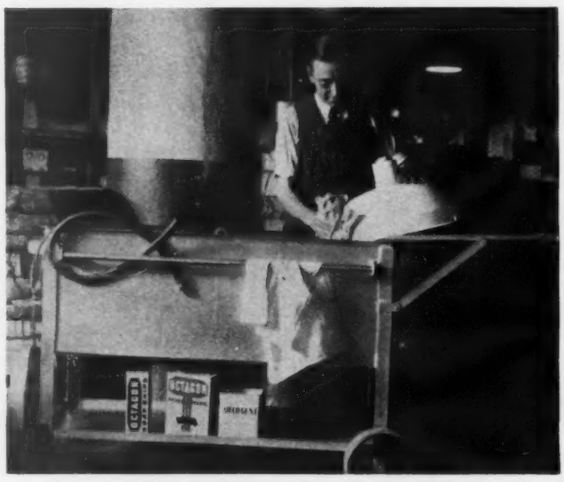
•

Portable Washer for Cleaner Reflectors

By L. M. DURYEE
Industrial Power Engineer, Connecticut Light & Power Company, Waterbury, Conn.

Realizing the economy of keeping its lighting equipment as clean as possible, the Patent Button Company, Waterbury, has been accustomed to carrying lighting reflectors to the wash basins in order to clean them. This was slow and costly, because the wash water was always a good distance away. Now the wash water is carried to the reflectors.

This portable, double-section wash basin was designed by Mr. Enoch Sprague, electrical engineer of the plant, to expedite the regular cleaning of several hundred lighting reflectors. The two sections of the tank are filled with water; both are kept hot for washing and for rinsing. The two sections are heated alternately with a 1,000 watt electric immersion heater, and nowadays the regular cleaning of lighting equipment is a relatively simple matter in this plant, for the portable tank is simply wheeled in place under each lighting unit. As the reflector is removed it is immersed in the hot water and washed, then rinsed in the water in the other compartment, dried and rehung. In addition to the electric heater for maintaining proper temperature, the tank is equipped with a hose connection for draining, and also with several towel racks around the sides. An electric fan on the lower shelf helps to keep the towels dry, for continuous use. That the Patent Button Company believes in simplified maintenance operations is indicated by this unique wash-tank. It also believes that if the mountain won't go to Mohammed,



Portable washstand heated by 1,000-watt immersion heater facilitates reflector cleaning and avoids chipping

Every house needs
Westinghouse

YOU KEEP YOUR PROFIT!

WESTINGHOUSE WATER HEATER

Service costs average only 73c per unit... DEALER-PROVED!

Here's an electrical necessity for the home that's mighty easy to sell — *and attention-free service keeps it sold!* It's Dealer-proved — exceptionally low service cost means high net profit!

An exclusive combination of four *Home-proved* features — gives you a top-notch, quality-product story to tell and provides the carefree, automatic 24-hour hot water service people want.

Make money and keep it — sell Westinghouse Water Heaters. Your Westinghouse Distributor will gladly show you how. Or, write Dept. 9070, Westinghouse Electric & Mfg. Co., Mansfield, O.

NEW ECONOMATIC CONTROL *Makes Selling Easy*

For prospects who want the utmost in water heating economy. Easily adjusted by the user to secure any water temperature from 120° to 170°. Prospects will like and want this feature.

Westinghouse Water Heaters are manufactured at Mansfield, Ohio, and Emeryville, Calif.

NEW! DIFFERENT! "CHECK-UP" PLAN

Let prospects play the selling game

Interesting new Quiz Game "How Hot is Hot?" entertains prospects while giving them important facts about the many uses for hot water. Sells Westinghouse Hot Water Service. Ties in with the new MKB program. Find out how the plan works. Ask your Distributor for details.

MODERNIZE ELECTRIFY with FIRCHER

Westinghouse *Home-proved* Water Heaters

"The Line of Least Resistance"

then Mohammed, quite often, can save time by going to the mountain,

One of the unexpected advantages of this device is the elimination of chipped porcelain. Formerly it was the practice to carry several reflectors at once to a distant basin; now each one is handled individually. Chipping and scratching are therefore entirely done away with.

•

Proving Farm Offers Comparative Costs

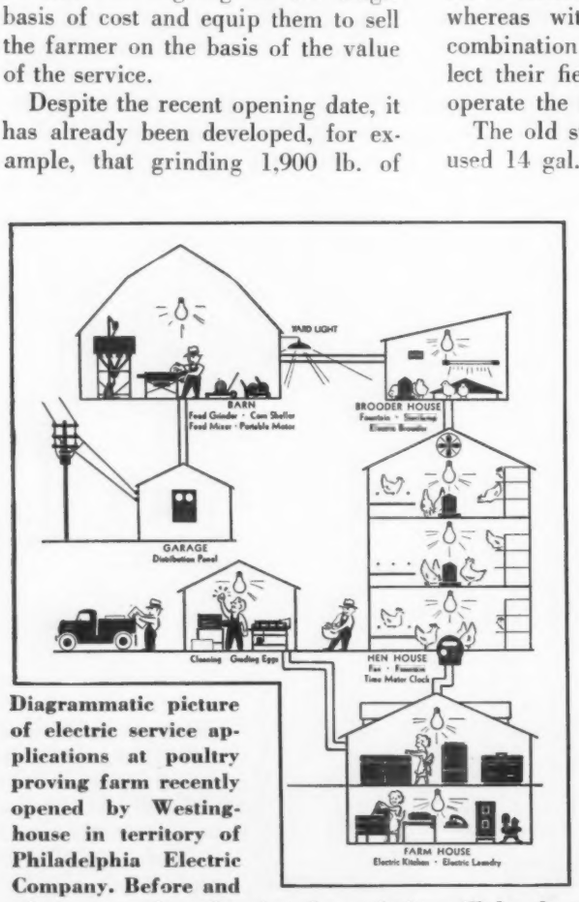
Comparative costs of many typical farm operations before the advent of electric service and afterward will be one of the major contributions to the industry by the new poultry proving farm recently opened at New Hope, Pa., and sponsored by Westinghouse and Philadelphia Electric. Such data will fill a vulnerable gap in the farm sales campaign as too little up to-date data are now available to remind the customer of the time lost daily before he began to use electric service.

Information of this type will relieve the utility and manufacturers' salesmen of arguing on the single basis of cost and equip them to sell the farmer on the basis of the value of the service.

Despite the recent opening date, it has already been developed, for example, that grinding 1,900 lb. of corn, oats and barley by tractor and a 30-hp. grinder cost 35 cents and involved 3.33 man-hours. The same job on the same farm now costs 14.5 cents and involves only ¼ man-hour when electric service is utilized. The 30-hp. grinder cost $365, compared to less than $160 for the new grinder and portable motor. The motor is also available for other farm tasks, whereas with the gasoline tractor combination men are obliged to neglect their fields and other chores to operate the tractor.

The old stove in the farm kitchen used 14 gal. per month, with a fuel cost alone of $2.45, little baking possible at all and a 29 minute job to fill the stove. Comparative figures for the new electric range will soon be available, which incidentally will eliminate the fire hazard inherent in the gasoline vapor cook stove.

Diagrammatic sketch in adjacent column shows the applications of service now being studied at this farm. Conversion of the farm increased connected load sevenfold from 3 kw. to 23 kw. The 1½-kva. transformer was replaced by a 5-kva. CSP transformer and ½ mile of wiring was installed.



Diagrammatic picture of electric service applications at poultry proving farm recently opened by Westinghouse in territory of Philadelphia Electric Company. Before and after costs of performing farm duties will be developed for sales ammunition

Modern fascia sign and window lighting are given credit by customer for sales records

Sign and Windows Herald Opening

By RALPH R. ENGHOUSER
Lighting Division,
Cincinnati Gas & Electric Company

It is unusual that the business of a new store equal that of an old established location the first month it is in operation. Stein's of Cincinnati opened a new store far removed from the original location and set a new record for sales. Mr. Stein, the proprietor, credits the modern lighting installed in his new store with the remarkable showing.

Because goods well displayed are half sold, Mr. Stein installed exceptionally good window lighting for a suburban store, using fifty-eight 150-watt distributing type reflectors.

Store easily identified

So that all persons passing by may identify this progressive store, a modern fascia sign was installed. The name Stein's in black was fired into glass with a cream background. Each sign is lighted by means of twelve 100-watt lamps.

Direct lighting, using 300-watt lamps in oversized opal inclosing globes installed on 10-ft. centers give 23 ft. candles of well-distributed lighting in the store.

As a result of this increase in sales Mr. Stein was induced to increase the intensity of the lighting at his old location and subsequently changed the wattage of the window lighting and of both floors of the interior store.

Hotpoint

OFFERS A NEW PORTABLE (NON-PRESSURE) WATER HEATER with Vast New Sales Possibilities

The famous CALROD heating unit is immersed directly in the water. Heats quickly, efficiently, economically.

Let this low-cost, fast-selling Hotpoint Electric Water Heater open your market to profitable water heater sales.

Use Voguette to educate prospects to the safety, cleanliness and dependability of electric water heating and make money at the same time.

Of two gallon capacity, Voguette is easily and quickly installed. It offers the simplest, safest, cheapest method of heating small quantities of water. Costs less than heating water on the range.

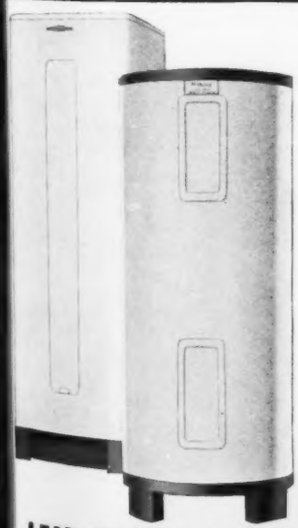
Get all the facts today and use Voguette to cultivate your territory for standard installations of Hotpoint Automatic Electric Water Heaters.

EDISON GENERAL ELECTRIC APPLIANCE CO., Inc.
5618 West Taylor Street, Chicago, Illinois

Open New Markets in Residential and Commercial Fields

Voguette can be plugged into any convenient outlet. Here are a few of the sales possibilities.

- Low Income Homes
- Summer Cottages
- Minimum Bill Customers
- Filling Stations
- Soda Fountains
- Tourist Cabins
- Roadside Stands
- Barber Shops
- Small Taverns
- Rest Rooms
- Doctor's Offices
- Dentist's Offices



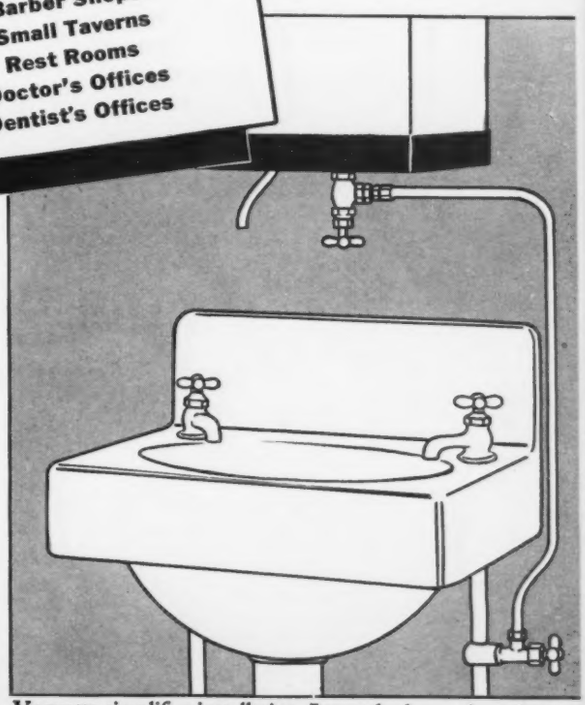
HOTPOINT OFFERS THE MOST COMPLETE LINE

Hotpoint offers a full line of electric water heaters in capacities from 1 to 140 gallons. A size for every need.

THE VOGUE. Hotpoint's popular rectangular-type water heater, smartly-styled for the modern home. Adaptable to kitchen, bathroom or basement installation — and commercial use.

THE MASTER. Hotpoint's famous round-style water heater, finished in white with contrasting black trim. Fully automatic and dependable. Economical to operate.

LEAD WITH HOTPOINT—THE LEADER OF THE INDUSTRY



Voguette simplifies installation. It may be hung above basin o sink. Plumbing connections are simple. No special wiring neces sary. Just plug into any convenient outlet.

BE READY TO REAP THE BENEFITS OF INDUSTRY CAMPAIGN

Tie up with the Modern Kitchen Bureau "Water Heater Campaign. Promote Electric Water Heating. Get your share of profitable business. Write for information to The Modern Kitchen Bureau, 420 Lexington Avenue, New York, N. Y.

ATER **Hotpoint** HEATERS

ELECTRIC RANGES · REFRIGERATORS · WASHERS AND IRONERS · DISHWASHER-SINKS

New EQUIPMENT AVAILABLE

Portable Brush Plater

Designed for electroplating by the brush process, this new power unit was developed for heavy and continuous operation using one or two brushes up to a capacity of 25 amp. A copper sulphide magnesium rectifying unit is used as a d.c. source. Signal light on the machine shows when it is in operation and dims when plating is applied.

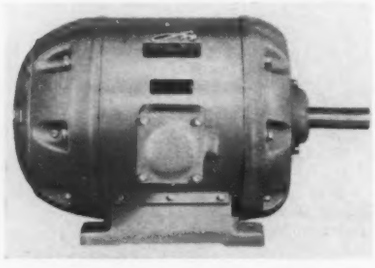
Model "IU-7" portable brush plater; operates on 115-volt 50-60-cycle a.c.; output, 2 to 10 volts d.c.; weight, 25 lb. **Portable Plating & Equipment Co.,** 1000 So. Michigan Ave., Chicago, Ill.

An ammeter indicates the amperage being used while complete instructions for the machine's use are printed on the name plate on the front. Utility uses of the machine include plating of bus bar equipment and switchgear for the elimination of copper corrosion and for higher electrical conductivity.

•

Explosion-Proof Motors

Enclosure of a new line of a.c. and d.c. explosion-proof motors is designed with a safety factor of five to protect against any likely internal explosion that may occur. An extra-large conduit box; removable aluminum-alloy fan, located on the commutator end of the motor; ribbed housing construction for greater strength and for increased heat radiating surface—and thus for cooler operation—are other features of the line. Motors are intended for use in Class I, Group D locations.

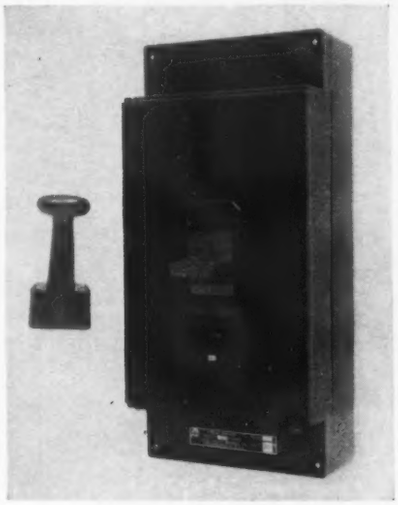


Type "326" frame motor, illustrative of new line of a.c. and d.c. explosion-proof motors; built to N.E.M.A. standards. **The Louis Allis Co.,** Milwaukee, Wis.

•

Air Circuit Breaker

While this air circuit breaker uses a standard 600-amp. frame, it incorporates a 20,000-amp. interrupting capacity. Poles are operated by a single handle and open or close simultaneously. Each pole is equipped with an inverse time thermal overload and an instantaneous magnetic trip feature, both operating on a common trip so that an overload on any pole opens the breaker. Handles of dark-red Bakelite are used to distinguish them from the standard 600-amp. breaker. Breakers are intended primarily for use as mains in panelboards and for circuit protection of main distribution feeders in switchboards where concentration of power requires a breaker of this interrupting capacity.



Type "ET-20" air circuit breaker; rated interrupting capacity, 20,000 amp.; convertible to either front or rear connection; trip units interchangeable; trip features calibrated at six to eight times rating of breaker. **I-T-E Circuit Breaker Co.,** Philadelphia, Pa.

•

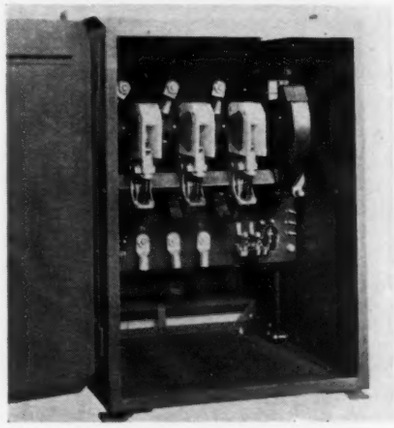
Strip Heaters

Strip heaters with porcelain-enamel cases. **General Electric Co.,** Schenectady, N. Y.

Porcelain-enamel steel casings are used on this new line of strip heaters to resist rust and corrosion. Heaters are designed for operation at sheath temperatures as high as 1,200 deg. F.

Non-Reversing Linestarters

Non-reversing linestarters are offered for application in across-the-line starting of large squirrel-cage motors or to serve as



Class "11-200-G" non-reversing linestarter for squirrel-cage and wound-rotor motors; in four sizes: ratings of 300, 600, 750 and 1,2000 amp., for two- or three-phase, three-wire service on 220, 440/600 volts. **Westinghouse Electric & Mfg. Co.,** East Pittsburgh, Pa.

primary switches for wound-rotor induction motors. Low-voltage protection or release through low-voltage relay; bimetal type of overload relay, hand or automatic reset; saturated current transformers for protection on slow starting applications and magnetic blowouts to provide adequate arc-rupturing capacity are features of the new models. Pumps, compressors, fans and blowers as well as other applications where pushbutton or remote control is needed and across-the-line starting is permissible are typical.

•

Rheostat Control

For soldering iron and pot control, this company has brought out a special rheostat which adjusts operating heat to the best value for the particular job. Use of such control is said to prevent overheating, reduce the accumulation of oxidation on the soldering iron tip and thus make

Rheostat control; in six ratings for irons or pots of 40 to 500 watts. **Ohmite Mfg. Co.,** Chicago, Ill.

When considering protection against current diversion losses, there are two vitally important questions you want answered. First, the performance of the equipment and second, the company who makes the equipment. Both questions are answered conclusively every day by scores of utilities and many thousands of installations throughout the nation. The story of performance is immediately available to all who are interested. Write for details.

Your file of Service Entrance Equipment data is incomplete without Corcoran-Brown catalogs. On request.

Electrical Department

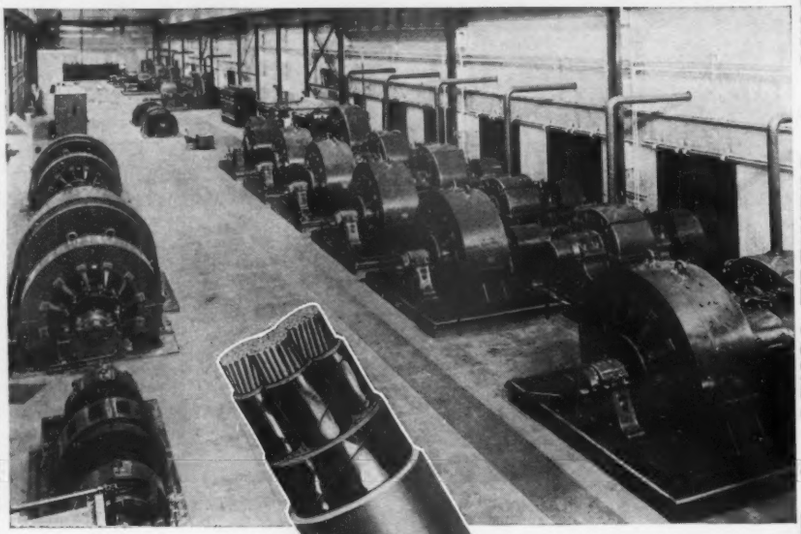
CORCORAN-BROWN LAMP DIVISION

THE ELECTRIC AUTO-LITE COMPANY

4900 Spring Grove Avenue — Cincinnati, Ohio

RUBBER COVERED POWER CABLES • BUILDING WIRE
VARNISHED CAMBRIC • FLEXIBLE CORDS • LEAD ENCASED AND PARKWAY CABLES • ARMORED CABLE
CRESFLEX NON - METALLIC SHEATHED CABLE • SERVICE ENTRANCE CABLE • MAGNET WIRE • BARE WIRE

CRESCENT
INSULATED WIRE and CABLE



INDUSTRY Uses It!

CRESCENT VARNSHED CAMBRIC POWER CABLE

Millions of feet of Crescent cables for power, light and control have been installed in industrial plants for the last fifty years with an enviable record for DEPENDABLE SERVICE.

ADEQUATE WIRING SERVES AND SAVES

CRESCENT
INSULATED WIRE & CABLE CO. INC
TRENTON, NEW JERSEY

Atlanta Baltimore Boston Buffalo Chicago Cincinnati Cleveland
Detroit Indianapolis Kansas City Los Angeles Minneapolis
New Orleans New York Philadelphia Pittsburgh St. Louis San Francisco

CRESCENT ENDURITE SUPER - AGING INSULATION

less tip cleaning necessary, and to speed up soldering operation. It may also be used to maintain proper stand-by or "idling" heats.

•

Air Flow Meter

Diaphragm-operated air flow mechanism for boiler meters. **Bailey Meter Co.**, Cleveland, Ohio.

To simplify the application of boiler meters to steam generating units in which high static draft conditions are likely to be encountered, this company has developed a diaphragm-operated air flow mechanism for its standard steam flow-air flow meter. Air flow connections from the boiler are made to a metal housing on each side of a coated silk diaphragm so that changes in differential pressure are measured and recorded in terms of air flow. Air supplied to the boiler for combustion is recorded by this mechanism and is coordinated on the boiler meter chart with the record of steam flow.

•

Baffle-Type Fire Nozzle

Non-turbulent distribution of gas from carbon dioxide fire extinguishing systems is said to be provided by these new baffle-

Baffle-type nozzle. **C-O-Two Fire Equipment Co.**, Newark, N. J.

type nozzles. Besides reducing velocity and pressure of the discharge, they are said also to permit rapid expansion and non-violent penetration of the gas throughout the protected area.

•

Resistors

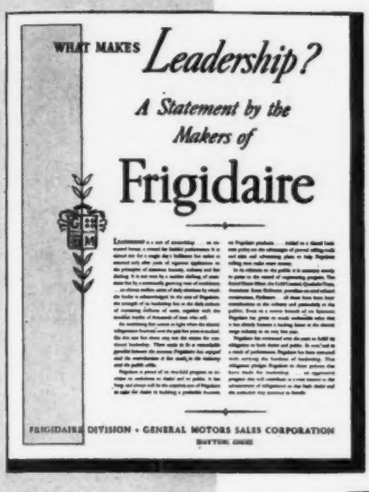
Type "FL" resistors; insulated for 1,000 volts; inclosed in metal case, over-all dimensions, approximately 6⅝ in. long, 1⅝ in. wide and 1¼ in. high. **International Resistance Co.**, Philadelphia, Pa.

Wire-wound resistance units are offered for use with fluorescent Mazda lamps and their auxiliaries on d.c. circuits. Resistors are enclosed in metal case and intended for mounting inside any conventional type of fixture or channel with the lamp auxiliary. Constructed to provide maximum heat dissipation in minimum space, it is claimed the units will operate at a temperature rise of from approximately 104 to 122 deg. F. with standard lamps and auxiliaries.

•

Fluorescent Reflector

An adjusting feature on this concentrating type of reflector for use with fluorescent lamps permits its to be set in any one of three positions. It may be mounted in a normal or symmetrical position, tilted to an intermediate position of approximately 22½ deg. from the normal, or tilted to the


WHAT MAKES *Leadership?*

A Statement by the Makers of

Frigidaire

FRIGIDAIRE DIVISION • GENERAL MOTORS SALES CORPORATION

DAYTON, OHIO

Leadership...

CONTINUED

Another Noteworthy Statement by the Makers of

FRIGIDAIRE

LAST FALL Frigidaire made a statement... and a promise. The statement manifested Frigidaire's acknowledgment of the obligations and responsibilities of leadership. The promise was a declaration that Frigidaire would continue to discharge its obligations to the continuous and joint benefit of public and dealer. We held that it was the duty of a leader constantly to lengthen his stride, ever speeding to new and farther horizons.

Today, America knows how Frigidaire has fulfilled, once again, its obligations. Today, throughout the breadth of the land, millions are hailing the new "Cold-Wall" Frigidaire as the greatest contribution to home refrigeration since the first days of the industry. Again, as in other years, Frigidaire has stepped forward with a new service, a new benefit to the public. And, in the wake of the introduction of this sensational new refrigerator, comes evidence that Frigidaire's understanding of its obligations has been endorsed without reservation. For dealers and customers everywhere are proclaiming this new Frigidaire the greatest of all time.

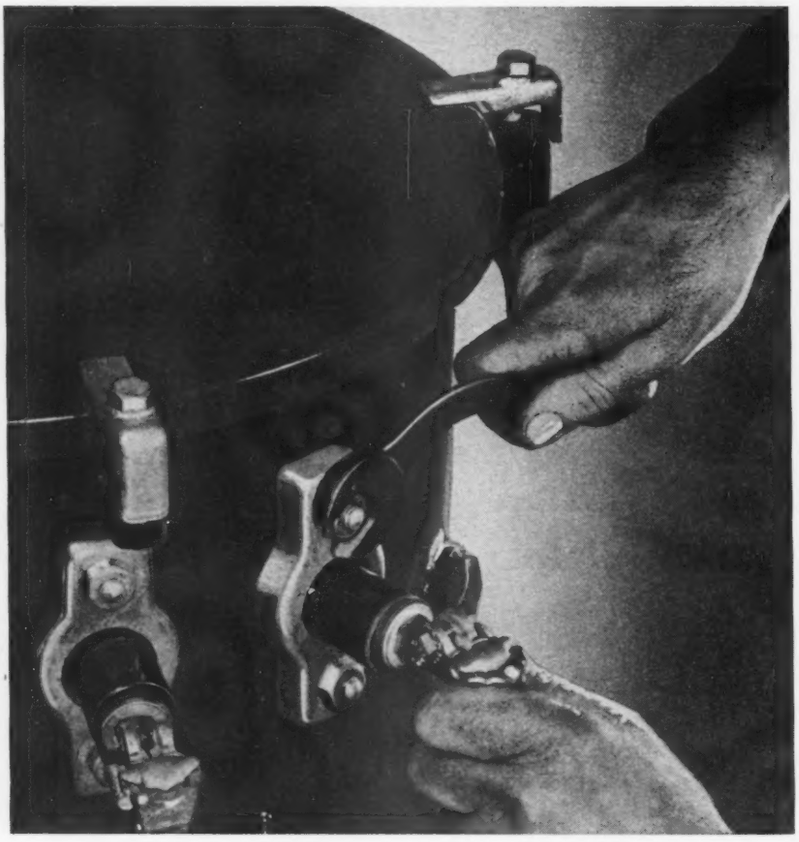
The entire line of new Frigidaire Refrigerators is testimony to the rigid adherence to aggressive policies. New beauty, new and greater convenience, new standards of economy, new contributions to the better keeping of food in the home...all these are embodied in every model from the highest to the lowest in price. And in electric ranges, electric water heaters, the public now knows the sincerity of Frigidaire's contention and aim that each succeeding year the customer is entitled to receive more from every dollar spent.

Great as this year's stride has been, it is merely another milestone to Frigidaire... just another step to the horizon that is just as far away today as it was the first day engineers set pencil to paper. Our objectives...made clear to the public by sensational new engineering developments... made clear to the selling organization by a new selected quality dealer plan . . . cannot but create another successful selling year with profit opportunities for all.

Let us repeat a statement we made several months ago: *Frigidaire is pledged to a continuously aggressive program that will contribute in a vital manner to the advancement of refrigeration so that both dealer and consumer may continue to benefit.* On this ideal, we believe, Frigidaire leadership has been built. And it will be because of this ideal that Frigidaire leadership will be maintained.

FRIGIDAIRE DIVISION · GENERAL MOTORS SALES CORPORATION
DAYTON, OHIO

Externally detachable



No Need for Tools Inside Tank

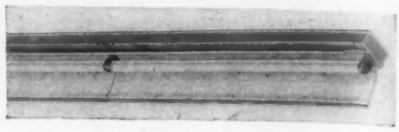
In a Pennsylvania distribution transformer, each lead is brought out through an individual bushing. The bushings are of wet process porcelain, each being individually bolted from the exterior! Thus there is no need to handle tools inside the tank. This pioneered Pennsylvania improvement not only affords greater convenience but greatly adds to transformer safety and further helps to keep maintenance costs at a minimum.

PENNSYLVANIA TRANSFORMERS

Pennsylvania TRANSFORMER COMPANY

1701 ISLAND AVENUE, N. S. PITTSBURGH, PA.

maximum angular or a symmetrical position of 45 deg. Reflector is of Alzak aluminum, said to have a coefficient of reflection of the order of 83 to 85 per cent.



Fluorescent reflector; in lengths to take 18-, 24- and 36-in. lamps. **Wiremold Co.**, Hartford, Conn.

•

Solenoid Valve

Type "H" solenoid valve; for control of water, air, gas, oil or steam; 10-watt rating on 110 volts, 60 cycles, a.c. **Supreme Electric Products Corp.**, Rochester, N. Y.

A novel scheme for electrical connections is used in this improved solenoid valve. Lower section of coil housing is empty, providing a terminal chamber into which wires are pushed after making the connections. Adaptor receives straight or angle BX connector or conduit lock-nut; for cord connections, a porcelain bushing is inserted in the adaptor. Composition tip in the impulse plunger and similar stop at upper end of plunger travel silence the customary "click" when valve opens or closes. Plug, containing seat, is removable for cleaning without removing electrical or pipe connections.

•

TECHNICAL BULLETINS

RESISTANCE WELDING—Material for a preliminary study of resistance welding, the machines needed and the control of these machines is presented in a Resistance Welding Bulletin published by Square D Co., Milwaukee, Wis. Schematic diagrams and photographs of the various types of machines are included. Timers of different types—induction, mechanical and electronic, for example—are considered.

N.E.M.A. STANDARDS—Standards relating to rating of distribution cutouts, performance, application and manufacturing are contained in Publication No. 38-53 of the National Electrical Manufacturers Association. In Publication No. 38-52 specialty transformer standards are compiled. It is divided into five parts: (I) Doorbell Transformers; (II) Signaling Transformers; (III) High-Reactance Control Transformers; (IV) General-Purpose Specialty Transformers, and (V) Luminous Tube Transformers. Copies of each publication may be obtained from N.E.M.A. headquarters, 155 East 44th St., New York, N. Y. The cutout standard is priced at 10 cents a copy and the complete transformer volume at $1.10, with the parts also offered separately.

PORCELAIN ENAMELING—Current problems in the fields of enameling shop practice, laboratory testing and the use of iron and steel for enameling stock are covered in the *Proceedings* of the Third Annual Forum of the Porcelain Enamel Institute. Copies are available from the institute, 612 North Michigan Ave., Chicago, Ill., at $2 each.

MOTOR DEFINITIONS—General information on N.E.M.A. standards and definitions as they apply to motors is presented in an eight-page Bulletin No. 610, published by The Louis Allis Co., Milwaukee, Wis. Suggestions for the proper selection of motors, types of drives and various types of protected motors are included.

HERE'S THE STORY,

as related by Mr. Myers

"THE 200 ampere fuses protecting our elevator circuits were a constant source of trouble blowing on an average of 10 times a month.

"About 5 years ago I installed BUSS SUPER-LAG Fuses of the same amperage. Since then I don't recall having as many as one blow per year —in fact I hardly know I have fuses in the house."

Why Should Any Plant Suffer Needless Blows **that can be prevented?**

Like all good fuses BUSS Super-Lag fuses protect plant and equipment against electrical hazards—and they DO MORE—as stated by Chief Engineer Myers, they protect against unnecessary and senseless shutdowns.

Naturally there are sound reasons for this kind of performance.

The design of the BUSS FUSE-CASE is such that it reduces to a minimum any chance for poor contact to develop in the fuse itself.

Hence heating from poor contact —that so often causes needless blows — is practically wiped out.

The Super-Lag development in the FUSE-LINK gives BUSS FUSES a retarded blowing point—or long time-lag that permits them to hold on without blowing when harmless overloads are piled on circuits already loaded.

Thus when motors start under load—or machines jam momentarily—or any of the hundreds of things occur that cause temporary, harmless over-currents, BUSS Super-Lag Fuses keep right on holding and the plant keeps right on running and nobody even thinks about the BUSS fuses that are holding down the job of protecting against electrical hazards.

The book "How to Select Renewable Fuses" tells the story. A free copy is yours for the asking.

•

BUSSMANN MFG. CO.
University at Jefferson
ST. LOUIS
Division McGraw Electric Company

WHY BUSS FUSES DON'T BLOW NEEDLESSLY
10 FEATURES in the design of the FUSE-CASE help make it possible..
The SUPER-LAG development in the FUSE-LINK completes the job.

Super-Lag FUSES

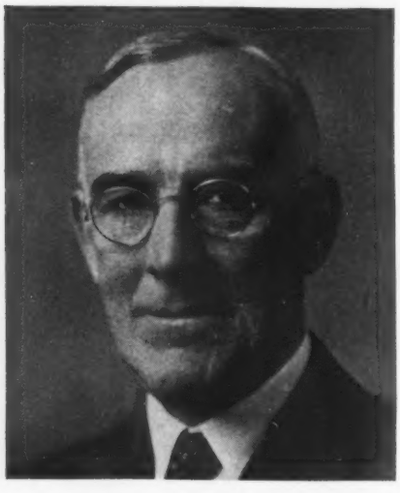
BUSS 1914 Silver Anniversary 1939 25 years progress in fuses

News ABOUT PEOPLE

Henry Made Vice-President of Montreal Utility Co.

At a meeting of the board of directors of Montreal Light, Heat & Power Consolidated, R. A. C. Henry, general manager of its Beauharnois subsidiary, was appointed a vice-president. C. C. Parkes, assistant secretary, was appointed secretary, replacing G. R. Whatley, who has retired on pension.

A native of Montreal, Mr. Henry was associated with the Canadian Pacific Railway from 1904 to 1908; in Government service in Department of Interior (water powers) 1908-1909; superintendent on various construction work, 1910-1911; joined department of railways and canals in 1912; director, bureau of economics, Canadian National Railways, 1923-29; deputy minister, department of railways and canals, Ottawa, 1929-30; resigned to become general manager, Beauharnois Power Corp., Ltd. in 1930. Mr. Henry



is a member of the Engineering Institute of Canada.

Mr. Parkes, new secretary of Montreal Light, Heat & Power, entered the company's new business department in the power sales division in 1919.

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▶ DANIEL W. MEAD, nationally known hydraulic, power and valuation engineer, with consulting offices in Madison, Wis., and New York, N. Y., was made the recipient of the Washington Award for 1939 by the Western Society of Engineers at a dinner held at the Drake Hotel, Chicago, on February 20. The award was made to Dr. Mead "for his superior contribution to sound theory, good practice and high ethical standards in the creation of engineering works as an engineer and as a teacher." He is a past-president of the American Society of Civil Engineers.

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Indiana Hydro-Electric Elects Mitchell President

Dean H. Mitchell, president of Northern Indiana Public Service Co., Hammond, was elected president of the Indiana Hydro-Electric Power Co. at a recent meeting of the board of directors. He succeeds the late John N. Shannahan. Indiana Hydro-Electric Power Co. is operated by the Northern Indiana Public Service Co., to the presidency of which Mr. Mitchell was elected in September, 1938 (ELECTRICAL WORLD, October 1, 1938, page 16).

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▶ W. FRED JORDAN has resigned as commercial and new-business manager of the Kansas Electric Power Co., Lawrence, Kan.

▶ R. E. FISHER, vice-president in charge of public relations and sales of the Pacific Gas & Electric Co., has been elected secretary to the board of directors of the Electric Appliance Society of Northern California.

▶ E. ARTHUR BALDWIN, vice-president and general European manager of the International General Electric Co., has been awarded the gold medal of the American Chamber of Commerce in France for distinguished service.

▶ GEORGE V. MCLAUGHLIN, president of the Brooklyn Trust Co., and NEAL D. BECKER, president of the Intertype Corp., have been elected to the executive committee of the Brooklyn Edison Co. Both are directors of Brooklyn Edison and trustees of Consolidated Edison Co. of New York.

Locke Insulator Elects R. G. Bellezza President

At the recent annual meeting of the board of directors of the Locke Insulator Corp., Baltimore, Md., F. H. Reagan, president since 1926, was elected chairman of the board. Russell G. Bellezza, formerly vice-president,

was elected president and C. B. Nairn was elected secretary-treasurer.

Mr. Reagan has been associated with Locke Insulator in various executive capacities for more than twenty years. Following a wide experience with several leading eastern railroads he joined Locke Insulator Manufacturing Co. in 1918 as vice-president in charge of manufacturing.

Mr. Bellezza became associated with Locke Insulator in 1936 in the capacity of vice-president. He previously had been connected with the General Electric Co., first in the street lighting department and then as manager of sales in the cable section, the position he left to join Locke Insulator Corp.

Mr. Nairn has been assistant secretary-treasurer of Locke Insulator since 1926.

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▶ E. B. MERRIAM has resigned from active service as engineer in the switchgear division of the General Electric Co., Philadelphia, Pa., to engage in industrial consulting work in New Haven, Conn. Mr. Merriam is still retained by

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"Quiet-Type" Insulators

Representing a completely new achievement in Ceramic Engineering

THOMAS "Q-T" INSULATORS set the standards for 1939

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FOR ELIMINATING RADIO INTERFERENCE

Positive Protection Guaranteed

The "THOMAS PROCESS" of eliminating radio noise from insulators consists of a specially prepared combination of metallic oxides applied — *prior to the glazing of the porcelain* — to certain critical areas of the unglazed clay body before "firing." Thus a thin film of metallic oxides is ceramically bonded in these areas to both porcelain body and glaze which acts to damp out radio noise effects through the resistance of the metallic oxides "coating." The electrostatic flux density is reduced at these areas to such an extent that corona is eliminated or reduced and the cause of radio disturbance fromr insulators is eliminated.

Permanent Protection Guaranteed

This completely new and exclusive "THOMAS PROCESS" offers permanent protection from radio disturbance because the metallic oxides "coating" is fully protected from all atmospheric, climatic and weather conditions by a layer of smooth glaze. Fundamental electrical characteristics of the insulator are not appreciably affected and design and contour remain exactly the same. Smooth surfaces are not impaired and the insulator is kept free from possible contamination as there are no grooves to afford a lodging place for dirt, rain, snow, or ice. Electrolysis effects or abrasions cannot take place as there are no "exposed" metallic substances. The glaze protected metallic oxides "coating" on Thomas "Q-T" Insulators is as permanent as the insulator itself—its function as long-lived as the porcelain.

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PIN TYPES
SUSPENSION
STRAIN
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For showing fluctuations in speed, we recommend our Jagabi Types A and C direct-reading Hand Tachometers.

Write for Bulletin 1505-W, which describes an attractive variety of speed-measuring instruments.

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ELECTRICAL INSTRUMENTS
1211-13 Arch Street Philadelphia, Pa.

General Electric in a consulting capacity. Mr. Merriam has been active in the A.I.E.E., having been a vice-president, 1928-1930, and a member of the Institute's committees on the Edison Medal, education and membership.

▶ John Clark, commercial engineer of the Stamford division of the Connecticut Power Co., has been appointed assistant manager of the division.

▶ Russell A. Ross has been appointed manager of the Tucumcari power and light plant, Tucumcari, N. M., recently taken over by the city. For several years Mr. Ross has been connected with an oil company in El Paso, Tex., in the electrical department.

▶ Harry Finch, chief engineer for Grays Harbor Railway & Light Co. since 1924, has been named superintendent of power for Albuquerque Gas & Electric Co. He succeeds the late A. C. Hicks. Curtis Cornwell, assistant chief engineer for the Grays Harbor company, has been promoted to acting chief engineer.

▶ E. B. Albert has been appointed chief engineer of the California Utilities Co. of San Francisco, which operates power systems in Susanville, Weaverville and Needles, Calif. Mr. Albert was formerly superintendent of transmission and distribution of the Northwest Public Service Co. of Huron, S. D.

▶ Winston E. Kock, head of the electronic research and development of the Baldwin Piano Co., Cincinnati, Ohio, has been named by Eta Kappa Nu, honorary electrical engineering society, as the outstanding young electrical engineer for 1938. Mr. Kock was chosen from more than forty candidates nominated from every section of the country.

▶ W. B. Gesell, formerly head of the rate department, Public Utility Engineering & Service Corp., has assumed the duties of chief analyst of the Oklahoma Gas & Electric Co., Oklahoma City. Mr. Gesell will exercise immediate supervision over the rate department of the company and will also concern himself with analyses and co-ordination of departments and departmental activities.

▶ James E. Bevan has been appointed assistant chief engineer of the Roller-Smith Co., Bethlehem, Pa. Mr. Bevan became associated with Roller-Smith in 1928, engaging for two years in plant efficiency work. From 1930 to 1933 he did sales work in the New York office and for the following six years served as switchgear specialist at Bethlehem. Formerly he was connected with the Bethlehem Steel Co. and with the oil circuit breaker maintenance department of the Philadelphia Electric Co., doing maintenance work in generator stations and substations.

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E. A. Lindemann Made Head of Lindemann & Hoverson

E. A. Lindemann has been elected president and treasurer of A. J. Lindemann and Hoverson Co., Milwaukee. This election makes Mr. Lindemann, who retains his position of general manager, one of the youngest major executives in the stove industry. Having taken a leading part in the management of the company for a number of

years, Mr. Lindemann is well qualified to continue the work started by his father, A. J. Lindemann, more than fifty years ago.

Viewing the future with confidence, Mr. Lindemann said: "The outlook for 1939 is promising. We have materially strengthened our engineering and production departments, and this, with a remodeling program which is rapidly nearing completion, and the re-styling of our lines, will put us in a position to meet the increase in business which we confidently expect."

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▶ Mrs. Ruth Stevenson has been made president of the Western Illinois Electrical Co-operative of Carthage, Ill. This is the first co-operative to select a woman as its executive head, although a number of others have women on their boards of directors. Commenting on the participation of women in co-operative rural electrification, Administrator John M. Carmody said: "For a long time I have felt that if REA projects are to be successful . . . more and more farm women must take an active part in the program from the beginning. In many cases the women will derive more benefit from the use of electricity than the men. They are more conscious of its need—

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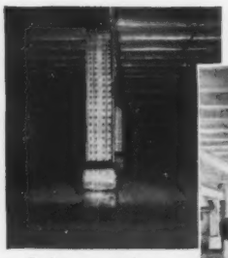
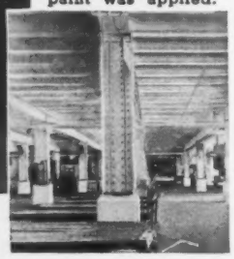
Outstanding in Service

UTILITIES SERVICE COMPANY

ALLENTOWN, PENNA.



and after one coat of this light reflective paint was applied.



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many of them will redesign their homes —they will have new kitchens and new kitchen arrangements. . . . The best way to find out about all of these things is to participate actively in the program."

▶ C. E. RENTCHLER, manager of the Drumright district of the Oklahoma Gas & Electric Co., has retired after 34 years of active service with the Oklahoma utility.

▶ JOHN W. CARPENTER, vice-president of the Long Island Lighting Co. in charge of the commercial department, has been elected a director of the company to succeed Arthur J. Baldwin, formerly general counsel, who retired on account of ill health.

OBITUARY

Major C. B. Wilcox

Maj. Clinton B. Wilcox, vice-president and Sandusky division manager of the Ohio Public Service Co., died of pneumonia, February 20 while on his way to Florida for a vacation. He was 72 years of age. Major Wilcox was a leader in nearly every phase of Sandusky's business and social life for more than 40 years.

His first long-term business service was given to the firm of R. M. and C. B. Wilcox Co., a dry goods company, where he spent 16 years and maintained an interest in that company until the firm was dissolved in the early 1920's. In 1902 he was made vice-president of the Sandusky Gas & Electric Co., and served that company in that capacity continuously until 1924 when it was merged with the Ohio Public Service Co. Since that time Major Wilcox has been vice-president of the company and general manager of the Sandusky division.

In addition, Major Wilcox was active in many other business and civic enterprises. He served as vice-president of the Moss National Bank and as a director of the Commercial National Bank. He was one of the organizers of the Sandusky, Milan and Norwalk Electric Railroad and served as a director of the company for many years. In the course of his career he was an officer of the Erie County Agricultural Society, Sandusky Board of Trade, Chamber of Commerce and served on the local Board of Health and as a director and trustee of hospitals.

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▶ WILLIAM H. MULLIGAN, engineer with the Ontario Hydro-Electric Power Commission, died suddenly February 7, in his fifty-fifth year. A graduate of McGill University in engineering, Mr. Mulligan was formerly in the employ of the Montreal Light, Heat & Power Co., the Electric Power Co. of Toronto and the Hanover Electric Co. He was chairman of the engineering committee of the public utilities branch of the National Safety Council.

▶ JOHN C. YORK, secretary-treasurer of the East Tennessee Light & Power Co., Bristol, and of the Tennessee Eastern Electric Co., Johnson City, died suddenly, of a heart attack, at the Pennsylvania Hotel in New York on February 17. Mr. York had gone to New York to prepare papers for the SEC looking to the merger of the two companies.

▶ GEORGE A. RUST, 55, purchasing agent of the Fitchburg Gas & Electric Light, Rockland Light & Power, Concord Electric, Exeter & Hampton Gas & Electric, Springfield Gas Light, Brockton Gas Light and other utilities managed from 89 Broad Street, Boston, Mass., died suddenly at his office in that city on February 21 from a heart attack. Mr. Rust was a native of Gloucester, Mass., and became associated with Charles H. Tenney & Co., Boston, in 1906, serving as purchasing agent from 1919 to 1936. He was a past-president of the New England Association of Purchasing Agents.

▶ ADMIRAL RALPH EARLE, U.S.N. retired, and president of the Worcester (Mass.) Polytechnic Institute since 1925, died suddenly on February 13 from a stroke suffered while addressing students in the Institute chapel. He was born at Worcester in 1874, and after attending the Institute entered the U. S. Naval Academy at Annapolis, being graduated in 1896. At Worcester Polytechnic he was an able administrator, and a vigorous advocate of breadth as well as depth of training in engineering education.

▶ CARL E. HARDY, superintendent of the electrical division, city of Oakland, Calif., died of a heart attack, in that city February 15. Mr. Hardy first went to California about 1908, when he became electrical engineer for Mare Island Navy Yard. Later he spent four years as commercial and industrial engineer in the sales department of Westinghouse Electric & Manufacturing Co., San Francisco. In 1915 he was appointed chief of the electrical division of Oakland. Mr. Hardy had been president of the southwestern section, International Association of Electrical Inspectors, and was second vice-president of I.A.E.I. itself, and long a member of the executive council. For many years he represented the southwestern section as a member of the electrical committee N.F.P.A., the National Electrical Code-making body. He was a member of the A.I.E.E.

"Yes, But Not a Caruso . . ."

In music . . . and in the world of business, there are names that shine above their contemporaries, in a field of excellence. They stand as symbols of what the public wants . . . The trade-name of "Chromel," for example, stands for heating-element wire that has the acceptance of the electrical public. Chromel is now 33 years old, and has become better with every year. And so, Chromel is a good name, to which the good name of device makers and dealers is safely entrusted . . . Hoskins Manufacturing Company, Detroit, Michigan.

The Wire That Made Electric Heat Possible

CHROMEL *Wire*

A GOOD NAME IN HEATING ELEMENT

Manufacturing AND MARKETS

Orders Gain Shown by General Electric

Orders received by General Electric Co. for the first two months this year totaled $51,800,000, as against $41,300,000 in the same 1938 period, a gain of 25 per cent, according to Gerard Swope, president. Directors at their meeting last week declared a dividend of 25 cents a share, payable April 25, as against 20 cents a share paid in the last three quarters of 1938.

Preliminary report for 1938 showed sales billed of $259,484,000, as against $349,740,000 for 1937, a drop of 26 per cent. Orders received totaled $252,176,000, against $379,274,000, a decrease of 34 per cent.

Net income for 1938 was $27,729,000, equivalent to 96 cents a share, as against $63,546,762, or $2.21 a share, in 1937. Cash dividend of 90 cents a share was paid in 1938, as against $2.20 a share in 1937.

Mr. Swope reported that current assets amounted to $182,767,000 and current liabilities were $27,744,000 at the end of 1938. Cash and marketable securities amounted to $98,715,000, against $47,536,000 a year ago. Inventories, after reserves, amounted to $68,518,000, against $93,768,000.

Capital expenditures for plant and equipment during 1938 totaled $12,000,000, against $20,600,000 in 1937. The average number of employees during the year was 59,917, as against 75,212 during 1937. Total earnings of employees amounted to $101,511,000, against $145,358,000, and the average annual earnings amounted to $1,694, against $1,933. Stockholders at the end of 1938 numbered 208,580, against 201,219 a year earlier.

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Electrical Exports Show 32% Decrease in January

Exports of electrical machinery and apparatus during January were the lowest for many months, totaling $6,720,000, as compared with $9,877,000 in December, a drop of 32 per cent and $7,767,000 in January a year ago, a decrease of 13.5 per cent, according to the Department of Commerce.

Exports of household refrigerators shared the general decline, numbering 6,210 units valued at $501,000 for January, as against 8,210 units valued at $632,000 in December and 9,242 units valued at $735,000 in January last year.

•

Manufacturers Issue Earnings Reports

The following electrical manufacturing companies have issued reports covering 1938 operations:

RELIANCE ELECTRIC & ENGINEERING—Net profit, $1,421, equal to 1 cent a share, compared with $390,772, or $2.60 a share in the previous year. President Clarence L. Collens told stockholders the company is continuing its policy of developing and improving its products, introducing cost reducing methods, and replacing obsolete or wornout machines. "Volume of business entered last five months of 1938 showed material improvement over the first seven months," he declared. "We entered 1939 not only with an increased volume of business compared with year ago, but also with every indication that the increased business will be maintained the first part of the year."

BABCOCK & WILCOX—Including wholly-owned subsidiaries, (preliminary report) net loss, $3,089,191, contrasted with net profit of $1,804,829 reported the year before.

CLARK CONTROLLER—Net profit, $55.928, equivalent to 35 cents each on 157,144 shares of common stock, compared with net profit of $504,963, or $3.20 each on 157,500 shares, in 1937.

CANADA WIRE & CABLE—Including subsidiaries, net profit, $462,655 equal after dividend requirements on 28,741 shares of 6½ per cent cumulative preferred stock and on 29,669 shares of $4 cumulative preferred class A stock, to $1.04 each on 150,662 shares of class B common stock. Net profit in 1937 was $794.252, equal after preferred and class A dividend requirements to $3.23 a share on class B common stock.

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Bonneville Bids Called

On March 16 the Bonneville Authority will open bids in Portland for metal-clad switchgear equipment for the south bank substation, also for current-limiting reactors.

Reports to Workers on 1938 Operations

Bridgeport Brass Co. has placed in the hands of its workers the annual report of the company for 1938. Ralph E. Day, president, said the statement was mailed to employees at the same time the annual statistical report was sent to stockholders.

The report, entitled "1938—What It Meant to Your Company," is a simple statement of assets under "This is what we own," as balanced against "This is what we owe."

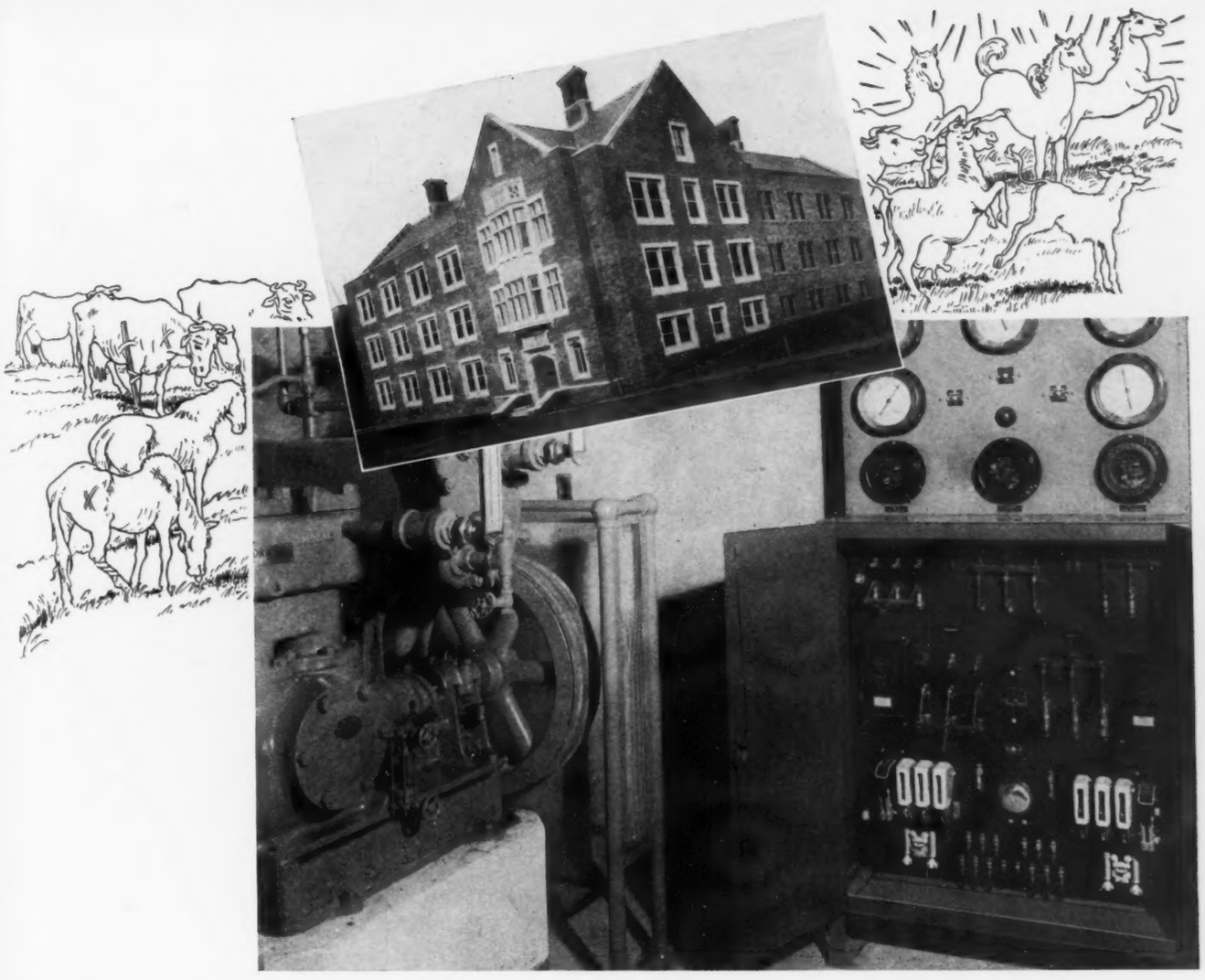
In a foreword to the report, Mr. Day declared: "The workers and the owners have exactly the same interest and are equally dependent one upon the other. As a matter of fact, the workers and owners are very much the same kind of people, for this company is not owned by one or two so-called 'rich men,' but by approximately 8,000 persons living in every state in the Union, with average holdings of less than 120 shares. The company has a large responsibility to this stockholder group, because if they had not invested their savings, there could be no company. On the other hand, the company has a very great responsibility to the workers who contribute their time, brains and labor."

Mr. Day presented a ten-year record of the operations of the company which showed a total of $32,938,913 paid in wages. He said the company expected this year to do better than last year.

•

Calls for Additional Bids on Shasta Dam Equipment

Additional hydro-electric equipment to be manufactured for installation in the power plant at Shasta Dam has been advertised by the United States Bureau of Reclamation. Bids are to be opened on March 15 in the bureau office in Denver, Colo., for furnishing turbines, governors and generators for two station-service units. Each unit will consist of a 3,500-hp. turbine, a governor for regulating the speed at 600 r.p.m. and a 2,500-kw. generator



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AUTOMATIC ELECTRIC MOTOR CONTROL

Monitor builds standard controllers, starters, and accessories, also custom-built apparatus for any electric motor control problem, no matter how complex. Monitor sales engineers in principal cities will gladly consult with you. Write us.

In the new laboratory of New York State's Veterinary College at Cornell University, Ithaca, New York, refrigeration plays an important part in the treatment of animals and in the preservation of serums.

The above illustration shows the highly efficient refrigerating plant installed by the York Ice Machinery Corp. together with its special control panel built by Monitor.

This panel consists of two 7½ H.P. across-the-line starters for compressor motors, two manual starters for brine pump motors, high and low pressure protection devices, disconnect switches for each motor, etc., all built and wired as one complete unit . . . The importance of unfailing dependability made ***Monitor*** control the logical choice for this up-to-date job. Permit us to consult with you on *your* control problems.

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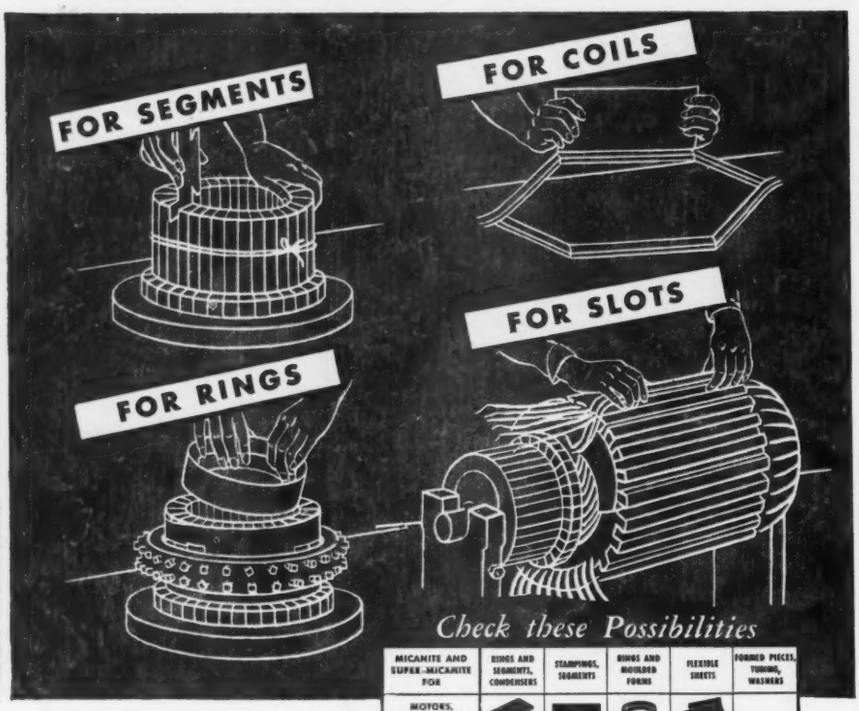
No Matter how tough the job—



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ARMATURES, COILS, STATORS			■	■	
TRANSFORMERS				■	■
CONTROL APPARATUS		■	■		■
HEATING UNITS		■			■
CABLES			■		
FURNACES					■
WELDING APPARATUS				■	■
X-RAY EQUIPMENT	■		■		■

*HERE IS A COMPANY that specializes in equipment for the "tough jobs". Motors and generators which they build operate some of the outstanding projects in the country. Obviously, insulation assumes an especially important part in keeping this equipment on the job—holding repair and replacement to a minimum.

Nine years ago they adopted Micanite segments for commutator insulation—found it ideal for their requirements. Then, switched to Micanite Rings, Micanite Tape for coils and Flexible Micanite for slot insulation. Today, Micanite in its wide variety of forms is the byword for insulation in their plant.

Consult the chart on the possibilities of making *full* use of Micanite on your own products.

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MICA INSULATOR COMPANY

MICANITE . . . EMPIRE VARNISHED INSULATIONS . . . LAMICOID LAMINATED PLASTIC MATERIALS

connected to the turbine by a vertical shaft.

Bids for furnishing four 103,000-hp. turbines for the main power units for the project are to be opened on March 14 in Denver. The date for this bid opening was changed from an original date of February 27.

•

Manufacturers Make Sales Assignments

Electrical manufacturing companies have recently announced the following appointments to their sales staffs:

Electric Controller & Mfg. Co. has appointed W. D. Falkenstein district manager of the Pittsburgh office to succeed A. C. Dyer, who has been made general sales manager of the company with headquarters in Cleveland, Ohio. Mr. Falkenstein has been connected with Electric Controller & Mfg. Co. in the Pittsburgh district since 1923.

Stewart-Warner Corp., Chicago, has appointed Household Appliance Corp., New Orleans, as distributor for the company's refrigerators, ranges and radios.

•

Manufacturers' Sales Gain 15.2% Over January, 1938

Manufacturers' sales of electrical machinery, apparatus and supplies, as reported for January by 91 firms, totaled $22,035,000, a decrease of 6.5 per cent from December and a gain of 15.2 per cent over January a year ago, according to the Department of Commerce.

These figures compare with a total sales volume for January of $293,296,000 for all industries reporting, representing a decrease of 3.6 per cent from December and a gain of 12.6 per cent over January last year.

•

Westinghouse Unit Buys Business of Iron City Co.

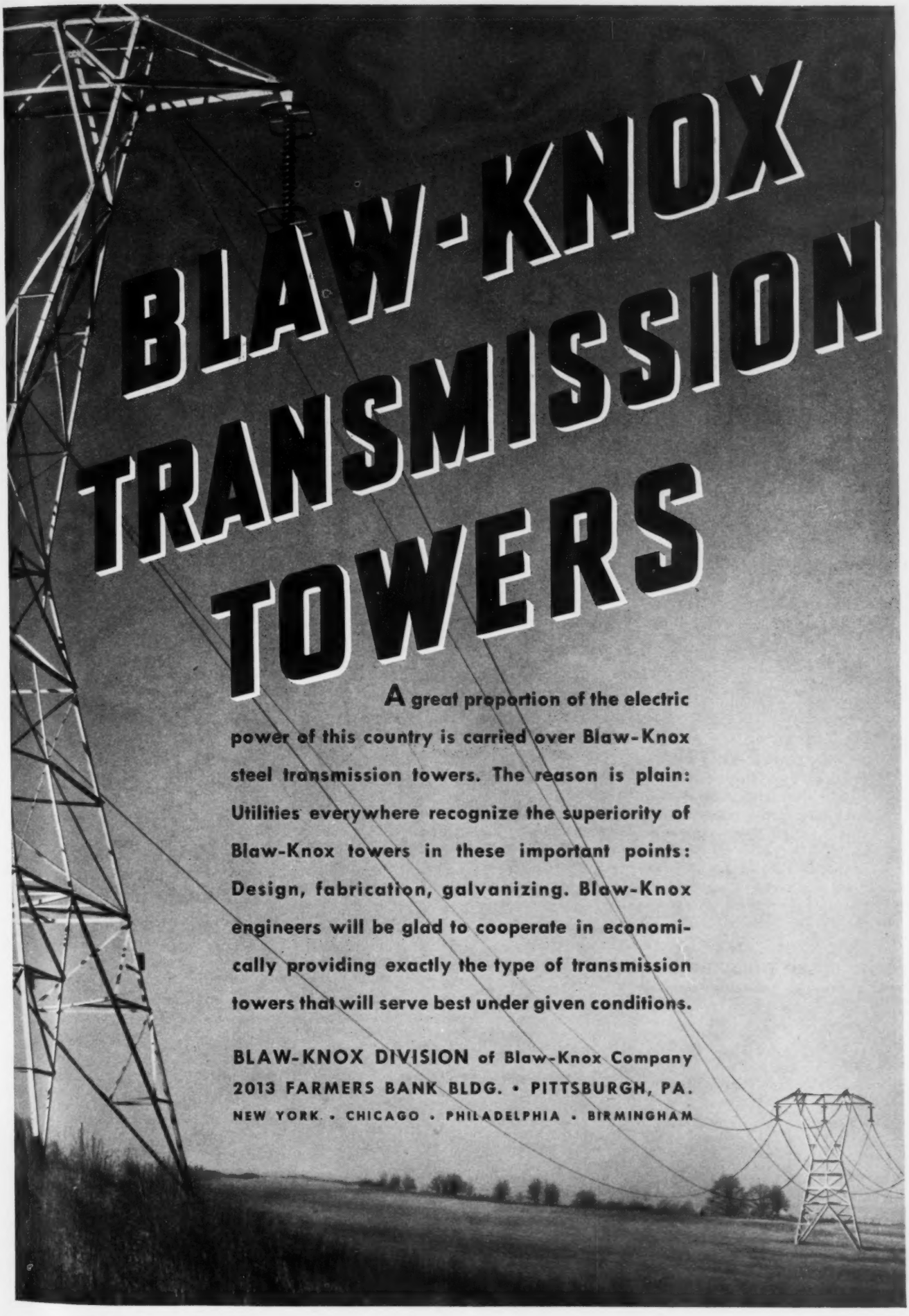
Westinghouse Electric Supply Co. has purchased the electrical business of Iron City Electric Co., electrical distributing company of Pittsburgh, according to Bonnell W. Clark, president.

Under the new management Warren I. Bickford, former secretary and treasurer of Iron City Electric, becomes district manager and Charles W. Ridinger, former president, is retained in an advisory capacity.

New York Metal Prices

	Mar. 7, 1939 Cents per Pound	Mar., 1, 1939 Cents per Pound
Copper electrolytic	11.25*	11.25*
Lead Am. S. & R. price	4.75	4.70
Antimony	11.25	11.25
Nickel ingot	35.00	35.00
Zinc spot	4.89	4.89
Tin straits	46 00	46 00
Aluminum, 99 per cent.	20.00	20.00

* Delivered Connecticut Valley.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TRANSMISSION
TOWERS
A great proportion of the electric power of this country is carried over Blaw-Knox steel transmission towers. The reason is plain: Utilities everywhere recognize the superiority of Blaw-Knox towers in these important points: Design, fabrication, galvanizing. Blaw-Knox engineers will be glad to cooperate in economically providing exactly the type of transmission towers that will serve best under given conditions.
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"Lightweight"
CLIMBERS

Klein "Lightweight" Climbers are built to the minimum weight possible consistent with maximum safety. Every pair is tested exactly the same as are the old time tried Standard Climbers. The lineman can throw his weight on these climbers with confidence —they are Klein's!

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Foreign Distributor: International Standard Electric Corp., New York

The four pamphlets listed below will be sent without charge to anyone interested. Check the ones you want:

- ☐ Lightweight Climbers.
- ☐ Specifications on Linemen's Belts and Safety Straps.
- ☐ Klein Kord Fabric Safety Straps.
- ☐ Pocket Tool Guide.

Mathias KLEIN & Sons
Established 1857 Chicago, Ill. U.S.A.

Field Reports on Business

Business is displaying more optimism regarding the future course of activity. Electrical manufacturers report an increase in orders during the first two months this year. Utilities are expected to come into the market for large amounts of equipment in the near future.

NEW YORK

Increased spending by public utilities so far this year is being reflected in the sharp rise in orders received by electrical manufacturers. While general business has continued to lag, after the sharp run-up last fall, expectations are that spring will bring a substantial revival in activity. Optimism has been increased by the friendly attitude being displayed by the government. Administration spokesmen are doing their best to woo business and reopen the capital market for expansion of plant facilities.

While President Roosevelt is urging Congress to clear its slate and "go home," there are many things on the calendar to be acted upon. Leaders point out that making a drastic reduction in appropriations to assure business against "wild spending" will be difficult, but must be done to insure against raising the national debt limit from the present 45-billion-dollar level. One encouraging move is seen in the public support of the economy bloc.

NEMA reported a sharp upsurge in wholesale purchases of major electrical appliances since the introduction of the new lines in January. The January gains ranged from 43 to 96 per cent over 1938 and increases over 1937 in two of three classifications covered. Utilities believe that once public confidence is manifested a substantial market will develop for home appliances. Several of the large companies are preparing to meet this increase in electricity use by budgeting new generating equipment.

PACIFIC COAST

Dealers report increased interest in major appliances but decidedly wary buying; refrigerators are apparently set for a fair year. Power sales are better and manufacturers report an increased volume of such "bread-and-butter" staples as medium-sized transformers and meters.

Drought is the only unfavorable factor, the seasonal rainfall in Sacramento Valley, future main source of the Central Valley water project, being one-third normal. Industrial business has slightly improved, greatest gain being registered in power apparatus sales, which include several 50-hp. motors, 40 transformers and special cable, total value $20,000, for Hawaiian sugar industries; $5,000 capacitors for flour mill; $20,000 motors and controls, sizes 15 to 400 hp., for gold dredgers; $5,000 electric locomotive and $6,000 special cable for gold mines, and $5,000 motor speed reducers and a 150-hp. motor and accessories, value $6,000, for lumber mills.

A $30,000 order covering subway transformers has been placed for central stock in San Francisco Bay area. A 12,000-kva. generator and 13,300-hp. turbine are being installed at El Centro for Imperial Valley service near the Mexican border and capacitors and other power-factor corrective equipment are being added to Tracy irrigation district in Central Valley. Further sales of 600 fractional-horsepower motors for pumping outfits and a 500-hp. size to Byron Jackson forecast excellent business to be derived this year from the slight rainfall.

CHICAGO

Enthusiasm over the general outlook was stimulated considerably by the Administration's apparent desire to cultivate business recovery through co-operation rather than reform. This feeling was attested further by the hopeful satisfaction expressed by leaders in various fields. However, buyers are reticent to make any sizable commitments because some of the uncertainties that have obscured the outlook for some time are still present.

Industrial activity showed a tendency toward expansion during the week. Steel production moved up several points and electrical power output increased 12 per cent over the comparable period a year ago. Orders for electrical equipment made a slight gain over the previous week, particularly in the industrial field.

Appliance sales show steady improvement over last year. It is especially encouraging to note that sales of the larger appliances have swung upward again. Fluorescent lamps are a dominant note in lighting as installations are rapidly increasing each week. Range sales are fairly slow, but are expected to pick up again within a month.

Building construction is moving ahead nicely and electrical contractors anticipate considerable increase in activity by spring. Electrical work on four new school buildings to be erected will total approximately $450,000.

NEW ENGLAND

Last week's sales of electrical equipment brought the total volume of orders placed in this district to date slightly above that recorded for the same period last year. An encouraging trend in present orders is reported by one representative in a widening diversity of equipment being considered by industries.

Last week, over $9000 worth of small motors were bought from one manufacturer, of which about half ranged from 5 hp. up to 15 hp., marking more activity among the large machine builders. Switch and control apparatus is receiving attention; much buying is noted by the U. S. Navy Department for replacements and new construction in the New England yards.

New air-conditioning equipment consisting of a 10-hp. condenser with a 10-ton rating together with a G. E. 15-watt ultraviolet short wave sterilizing unit have been installed in the new 250-seat capacity Telepic Theatre in the Park Square Building, Boston. Street lighting is advancing and several interesting projects are being studied. One eastern Massachusetts municipality is considering spending about $25,000 on new street lighting equipment. Town appropriations for the current year for new lighting projects total more than the amount proposed last year at this time.

The Connecticut Light & Power Co. built 152 miles of rural line last year. Electric service is now available or used by 81 per cent of the farms in its vicinity. Merchandising during the past month showed improvement.

Establishes Method of Measuring Radio Interference

[*Continued from page 50*]

ingly have part of the noise existing on the high-voltage conductors induced in it. The coupling factor between the two circuits might lie anywhere between 0.05 and 0.50 or more and the noise level induced in the distribution network would lie between 5 and 50 microvolts.

The distribution circuit noise level is subject to losses in transformers and attenuation along the line so that by the time it reaches the customer it will again be reduced. Finally, the coupling between the supply lines and the receiving antenna will result in additional losses so that the final noise level in the antenna circuit would be negligible.

The advent of a radio interference yardstick would be welcomed by insulator manufacturers and utility men alike. The manufacturer could use the yardstick to check the interference characteristics of his various designs and the power company engineers could rest assured that insulators which meet the specified standards would not cause disturbance when installed on their lines.

•

British Consumption of Electricity Sets Record

Electricity consumption in Britain reached an all-time high in the third week of December, 1938, during the abnormal cold spell. On Tuesday, December 20, the total load on the generating stations associated with the national grid was about 6,714,000 kw., more than 15 per cent above that for the previous Tuesday.

Electricity output continued its gains in Britain during November and for the first eleven months of last year totaled 21,700,000,000 kw.-hr., as against 20,405,000,000 in the corresponding period of 1937.

•

Will Use Glass Fibre

Westinghouse Electric & Manufacturing Co. has begun the commercial use of glass fibre, spun in the form of a cloth. The company will use it to insulate large turbines, refrigerators and electric stoves and is developing means to use for wire covering and air filters. Officials of Owens-Corning Fibreglass Corp., Toledo, have been conferring with Westinghouse engineers in Pittsburgh concerning the use of the glass fibre as an insulating material.

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The receiver also benefits when the Acme Unit-load method is used to brace poles on flat cars. Personal injury hazards previously encountered in unloading are eliminated. The unloading crew has accurate control over each step of this safer—faster—more economical unloading procedure.

An increasing number of shippers are using this labor and time saving method of bracing cars. Delay and loss of poles in transit are avoided. And shipments arrive in excellent condition.

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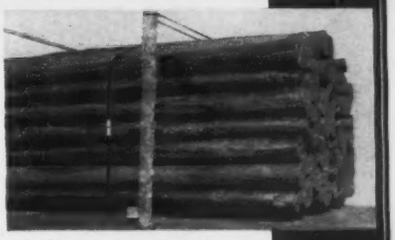

1 *View of car braced with Acme Unit-Load Bands.*

2 *Showing how safely and easily bands are removed from side opposite unloading side.*

3 *Tension is gradually eased and poles roll safely off the car.*

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BOOK REVIEWS

Alternating-Current Circuits

By Bryant, Correll and Johnson. Published by McGraw-Hill Book Co., 330 West 42d Street, New York, New York. 522 pages. Illustrated. Price, $4.50.

This, the third edition of "Alternating Current Circuits," a text for an introductory course in the study of alternating-current circuits and transmission lines, embodies several changes over the second edition of 1931. Use of the polar form of the vector in its application to mesh circuits has been extended. New material has been added treating mutual inductance and mesh circuits. Definitions have been changed and extended to conform with new standards of the A.I.E.E. Problems at the end of each chapter have been changed and many new problems added.

First six chapters discuss theory of alternating-current circuits and develop the equations applying to the various types of circuits from the fundamental physical and mathematical principles. The remaining chapters apply these principles to polyphase circuits and transmission lines.

•

Fundamental Principles of Physics

By Herman G. Heil and Willard H. Bennett. Published by Prentice-Hall, Inc., New York, N. Y. 631 pages, illustrated. Price, $5.

Engineering curricula are undergoing transformation everywhere and the changes are reintegrating the largely divorced pure science and applied science. This book appears to have been written in response to that trend. It emphasizes the mechanics and thermodynamics in keeping with the new professional registration requirements for engineers. Calculus is not introduced until the student has had an opportunity to catch up with differentiation in his simultaneous calculus course. Few words are wasted, so forthright and compact is the language of exposition. There is a good chapter on wave motion preparatory to sound and light. The condensed section on electrophysics is followed by one on atomic physics. Problems have been provided (without answers) in ample measure.

•

Menlo Park Reminiscences, Vol. 2

By Francis Jehl. Published by the Edison Institute, Dearborn, Mich. 915 pages, illustrated. Price, paper cover, $0.50; Cloth, $1.

This second volume of Edisonia sustains the reverential regard established in the first for the Wizard of Menlo Park. New flavor is injected by Mr. Jehl's pains to debunk some of the exaggerated anecdotes about Edison without, however, a bit of derogation. The author knows he can afford to grant discounts. He seems too to sense that he had a duty to portray the personality as one having human attributes and foibles as well as an eerie supermind. Touches of humor also mark these additional reminiscences. The "corpse reviver" tale is inimitably told.

In rather delightful manner he ignores chronology in his sequences and reversions, thereby perpetuating the accepted notion that the wizard was engrossed with a dozen problems at once, bringing each to fruition in incredibly short time.

Here then we get the origination of the network idea, the initiation of the compounded motor and the fourteen other "firsts" conceived by the master mind. Here, also, is the true story of the worldwide search for the successful filament material—a palm leaf fan giving the primary inspiration.

The second volume will also be esteemed for the correlation it affords with the careers and scientific bents of the contemporary celebrities in that electrical era which laid the foundation of the marvelous electrical commonplaces of today, few not traceable directly or indirectly to Edison.

•

The Engineers' Manual

By Ralph G. Hudson. Published by John Wiley & Sons, Inc., New York. 340 pages. Price, $2.75.

After several printings of the first edition (1917), the author has grasped the opportunity to revise rather extensively this compilation of formulations of heat and electricity. Among the latter, as typical, are the common basic expressions (absolute and practical unit forms) on transient currents, harmonics, three-phase equivalences, machine-design formulas, transmission (including hyperbolics), etc. The book, therefore, remains a systematic compilation and interpretation of the formulas and constants of mathematics, statics, dynamics, properties of materials and structures, hydraulics, thermodynamics and electricity. Comprehensive mathematical tables, weights of materials, steam tables, conductivities and conversion factors close the book. For the engineer who wants the right formula applied rightly in terms of the right units.

•

Theory and Application of Electron Tubes

By Herbert J. Reich. Published by McGraw-Hill Book Co., 330 West 42d Street, New York. 690 pages, illustrated. Price, $5.

Written essentially as a textbook, this nevertheless has much value for the electronics control application engineer. This is a permissible characterization because the method of treatment, after reviewing the theory of tube action, analyzes and emphasizes the functional performance of the many types in conjunction with a similar number of circuit arrangements. A considerable number of non-radio applications is indicated in the latter third without aspiring to present anything like a complete assembly of the multitude of applications that have been effected. The author is more intent on making clear the quantitative interpretation of electron tubes so that the designer of control applications as well as the radio engineer can select the most appropriate assembly and obtain optimum results for the specific case in hand. In this sense the book is unusually complete and direct. In addition to the graphical and numerical data interspersed throughout the chapters on amplification, modulation, oscillation, gaseous conduction, glow and arc discharges, photocells and tube instruments there is an appendix of graphical average characteristics for several common tubes commercially available.

New Station Strengthens Buffalo System

[*Continued from page 65*]

of the bus is equipped with bus differential and back-up relays. Each transformer bank is equipped with power-directional and ground-directional relays on the 22-kv. side. The high-tension relays are located at the Gardenville station along with the high-tension oil circuit breakers. Staged fault tests were made to check the operation of the various relays under actual fault conditions. Feeder faults were cleared in eight cycles and bus faults were cleared in twelve cycles total time.

Lightning protection

Lightning protection consists of ground wires over the 110-kv. lines, lightning rods and masts adjacent to the structures (see Fig. 3), lightning arresters and rod gaps near the transformer terminals and a very complete ground network throughout the station area. This network consists of No. 4/0 solid weatherproof wire, buried about 1 ft. below the surface of the ground and connected to each column of all of the structures, all oil circuit breaker frames, all disconnecting switch-operating mechanisms, water piping, lead cable sheaths, etc. There are about 200 ground rods driven 10 ft. into the ground and connected to this ground network.

The entire station area is covered with crushed stone with drain tile underneath to prevent the spreading of oil. Crushed stone beds with adequate drains are provided around each transformer. Each transformer is equipped with spray nozzles with automatic release. Portable extinguishers are provided at convenient locations. These are principally of the carbon dioxide type. Spray nozzles and hose are provided and hydrants are so located that at least two lines of hose can be brought into play on a fire anywhere in the station area.

•

New X-Ray Machine

A new X-ray machine, which is said to produce X-rays at rates 20,000 times greater than commercial machines heretofore available, has been developed in the General Electric research laboratories, as revealed in a patent granted to Kenneth H. Kingdon of Schenectady, N. Y.

• Wood Pole Structure for 6600 v distribution system forming a turn of ninety degrees.

• Steel Switching Tower erected at Fort Peck, Montana.

EXPERTS ON NEW CONSTRUCTION Under all kinds of conditions

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SWITCHING STRUCTURES · SUBSTATIONS · POWER HOUSES

Illustration above shows how easily current measurements are made with Tong Test. Open tongs—encircle conductor—close tongs—there's the reading.

Voltage measurements can also be made with Voltor, a Tong Test attachment described in the Tong Test bulletin.

Give Your Service Men A "Break"

Save your service men a lot of time every day by equipping each with a Tong Test Ammeter. Tong Test alone has all these features.

Universal—measures A. C. and D. C.
Accurate—within 2% on A. C.
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Multi-Range—up to 1,000 amperes.
No breaking of circuit or insulation.
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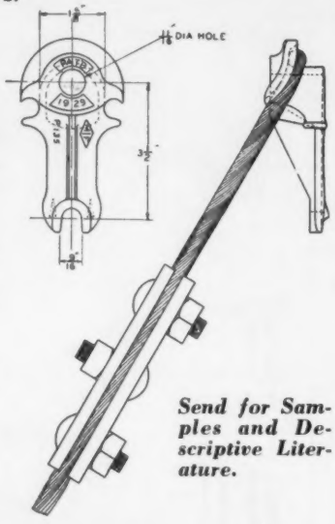
550,000 Installations Can't Be Wrong

M.I.F. Through-bolt Guy Hooks have been installed to this extent during the past three years in the U.S. and Canada by Operating Companies comprising a majority, expressed in terms of generating capacity or number of meter customers. We would recommend this neat, effective, economic, and hazard-minimizing guying method to those Companies that have not yet tried it. Investigation pays.

Guy Hooks—Three principal types in addition to the P134 Crossarm Guy Hook. P135 rated at 13,000 lbs. on ⅝" through-bolt is also approved for R.E.A. projects. P133 rated at 20,000 lbs. on ¾" through-bolt. P132 rated at 40,000 lbs. on 1" through-bolt. Make up guy loops on the ground and save time of the whole gang. Prices as low as 15c each in quantity.

Eye Nuts and Anchor Rods—Thimbleless Eye Nuts for ⅝" bolt as low as 12c each in quantity. Larger sizes for ¾" and 1" bolts. Double Eye Nuts and various types of Bolt Eyes also available. Also furnished assembled and galvanized as unit on special steel rods of any desired length, rated at 80,000 lbs. per sq. in. at correspondingly attractive prices. These Eyes, used with standard stocks of through-bolts, round out simple specifications for pole-to-pole guys, etc., other than anchor type served by the Guy Hooks.

Curved Washers—Full line of Curved Ribbed Malleable Washers using the metal to better advantage than plate washers of uniform thickness, minimizing the pole-splitting stresses of through-bolt guying of any type, and strictly competitive as to price.



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BURNDY ENGINEERING CO., INC., 459 E. 133 ST., N.Y.C.

Doesn't Make Sense, Somehow

[*Continued from page 70*]

that his vote had reduced the chances of his own district or state getting more federal gravy!

But that is not all. Shortly before this controversy arose in the House, Engineer Tom Panter, of the special congressional committee which investigated the TVA critics, submitted his report. The original was given, naturally, to Chairman Vic Donahey. A copy was given to Counsel Francis Biddle, whose zeal in the investigation so pleased the President that Mr. Biddle has since been made a federal judge.

Whitewash expected

As the committee is to hold no more hearings, one might have thought that copies of this report would have been shown to all its members, as the writing of the final committee report is all that remains to be done. The minority members of the committee would especially have liked to look at that report, as at least three of them will never sign the majority report—expected to be a whitewash.

But no. That report was carefully suppressed until after the new TVA appropriations were safely through Congress, waiting the President's signature.

Now this is very puzzling, because no one who remembers what Arthur E. Morgan said about Panter in objecting to his appointment dreams that the engineer's report will reflect anything but credit on TVA. Apparently, however, it was felt by some one that this was no time to take chances. Some little passing remark in the Panter report might enable Representatives Wolverton or Jenkins, or Senator Davis, to flame out with an attack which might have jeopardized that dam appropriation —to change the six votes that might have beaten it.

•

New Gatineau Power Unit

Gatineau Power Co. has completed the installation of a new 34,000-hp. generator in its Chelsea hydro-electric plant on the Gatineau River in Quebec. This is the fifth unit of similar capacity in the plant and completes the station to its full designed capacity of 170,000 hp. The cost of the new generator was financed from current cash funds.

HENRY used to throw his pliers at anyone who wistfully whistled "Home Sweet Home" when he was working almost every night rewiring faulty circuits. Now he swings it on the way to supper and enjoys evenings at home, because the "Ten Tested Rockbestos Values" solved his overtime problem.

You may not operate a night shift on electrical maintenance, but don't forget that any single production delay caused by wire-failure may carry a loss that far exceeds the entire cost of proper wiring. Rockbestos users testified to this when they endorsed the ten tested values with these remarks: "No periodic replacement just when attention is needed elsewhere—" "Lowers our production costs by preventing shutdowns." "Rockbestos . . . the answer to a maintenance man's prayer." These unsolicited statements and many others were received from men who are convinced that Rockbestos saves money in reducing maintenance expense and keeping up production schedules . . . perhaps it can do the same for you.

Take an inventory of your money-wasting circuits, check the trouble-causes against the "Ten Tested Rockbestos Values" and let our engineers help you with your problem. For information, samples or a catalog, write to Rockbestos Products Corporation, 916 Nicoll Street, New Haven, Connecticut.

TEN TESTED ROCKBESTOS VALUES

1. Heatproof
2. Fireproof
3. Permanent
4. Lower maintenance cost
5. Resists heat and vibration
6. Saves work
7. Oil and Greaseproof
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Also refer to Electrical World Buyer's Reference

ROCKBESTOS A.V.C.—*the wire with permanent insulation*

AMELECTRIC
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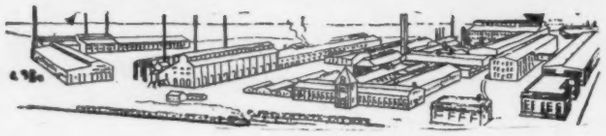

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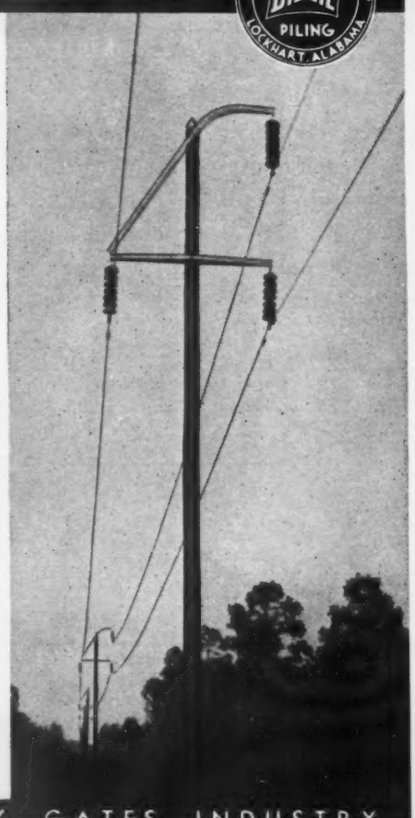


A CROSSETT WATZEK GATES INDUSTRY

Utility Business Not Interstate

[*Continued from page 45*]

still clearer by the dissenting opinion, wherein Mr. Justice Butler said: "The facts on which it (the board) assumed to assert power need not be narrated; they are sufficiently stated by the lower court and in the opinion here (meaning the prevailing opinion). Both courts rightly treat the case as one where neither employers nor employees are engaged in interstate or foreign commerce. Here, the *employers are engaged solely in intrastate activities.* A very small percentage of the product furnished in that state to *others* is by it *later* used in interstate commerce."

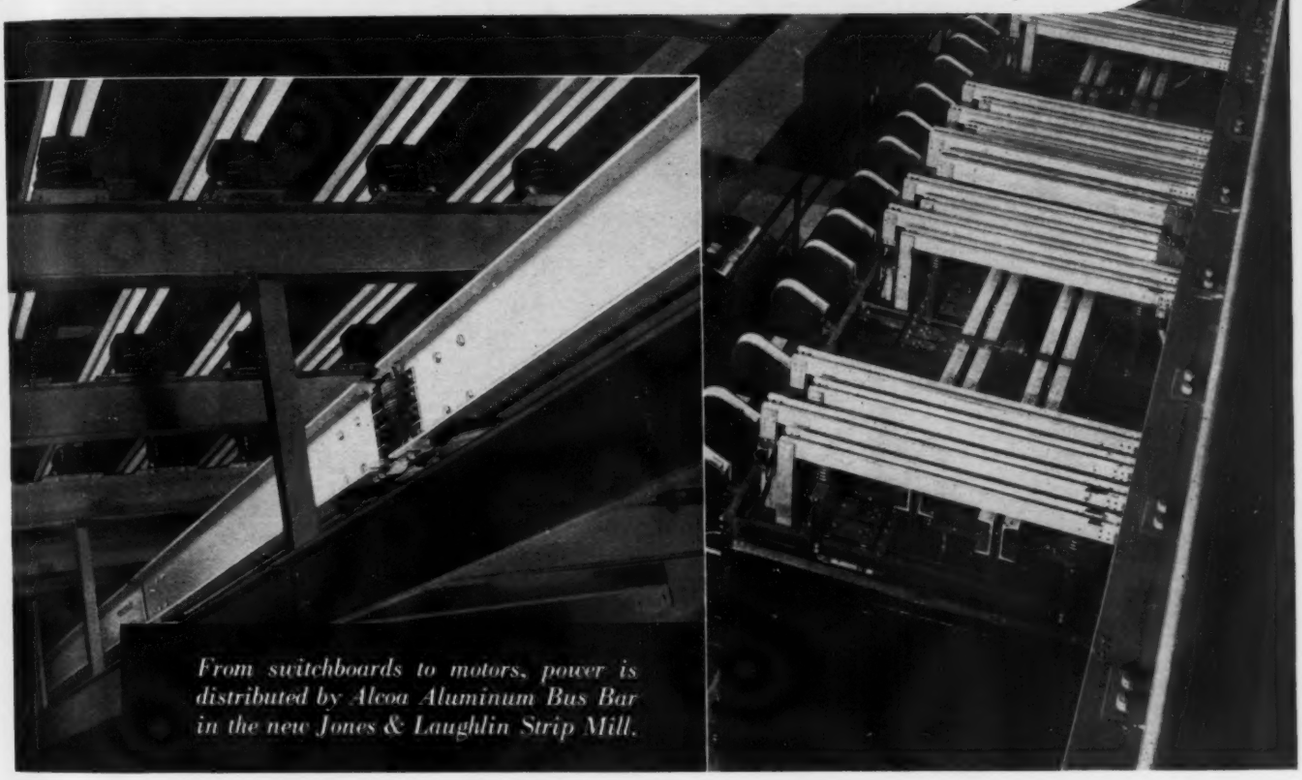
The "both courts" referred to are the United States Circuit Court of Appeals and the Supreme Court, which was then deciding the case. The matter came before the Circuit Court of Appeals for the Second Circuit directly by petitions by the company and others for a review of an order of the National Labor Relations Board, and the case went to the Supreme Court on writ of certiorari. It is clear, therefore, that the two dissenting justices (Mr. Justice Butler and Mr. Justice McReynolds) did not consider that the Justices who concurred in the principal opinion of Mr. Chief Justice Hughes had ruled or were ruling that the company was engaged in interstate commerce. I know of no better criterion by which to judge of the scope and meaning of a judicial opinion than the statement of members of the court who heard the case and had something to do with the decision. So I think we may rely upon Mr. Justice Butler's statement that the Supreme Court was rightly treating the case as one where "neither employers nor employees are engaged in interstate or foreign commerce."

As stated, Mr. Chief Justice Hughes, in his opinion stresses the protective character of the Wagner Act. Thus, after referring to the possible disruption of interstate commerce by industrial strife, he says: "Congress was entitled to provide reasonable preventive measures, and that was the object of the National Labor Relations Act." Again, he says: "But it is also true that where the employers are themselves engaged in interstate or foreign commerce, and the authority of the National Labor Relations Board is invoked to protect that commerce from interference or injury *arising from the employers' intrastate activities,* the question whether the alleged unfair labor practices do actually limit interstate or foreign commerce in a substantial manner is necessarily presented."

The jurisdiction of the N.L.R.B. was sustained on the theory that it was

EFFICIENT ELECTRICALLY—LIGHTWEIGHT AND STRONG

Alcoa Aluminum Bus Bar



From switchboards to motors, power is distributed by Alcoa Aluminum Bus Bar in the new Jones & Laughlin Strip Mill.

Electrical loads are heavy in the steel mill, with sudden rushes of current as motors are thrown across the line, plugged, reversed or stalled under heavy overloads. Alcoa Aluminum Bus Bar provides the current carrying capacity required for steel mill circuits and the strength to withstand the high strains imposed on these buses.

The lighter weight of Aluminum Bus Bar reduces the burden on structures supporting it. Supports can be lighter, cutting their cost considerably. Aluminum can be "tailored" to fit each individual job. Joints are made by bolting, or welding. Simple, inexpensive fittings are available.

Our engineers will gladly assist you in selecting proper Alcoa Aluminum Bus Bar to meet your requirements. ALUMINUM COMPANY OF AMERICA, 2138 Gulf Building, Pittsburgh, Pennsylvania.

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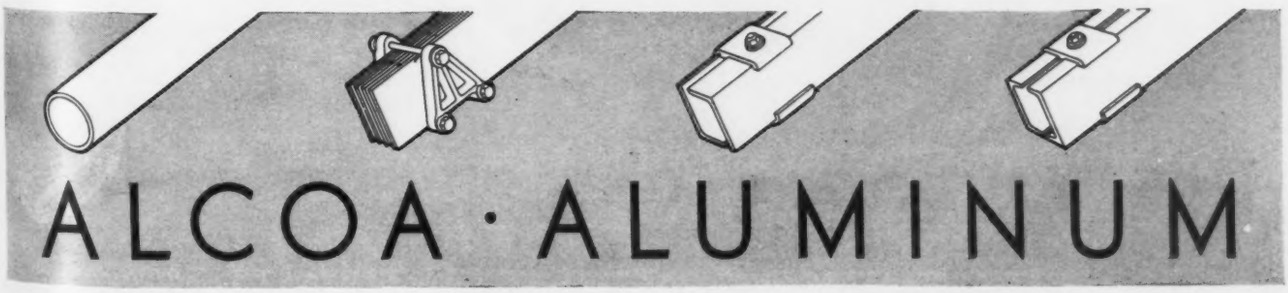
"Make metal housings of Aluminum. It's non-magnetic, but easy to fabricate; sheet and structural shapes may be purchased from stock. Aluminum, though light in weight, makes housings strong and neat. It resists corrosion and retains a pleasing appearance in industrial atmospheres."



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Of course a 7-foot fence is 7 feet high, but the point is that PAGE service will help you select the proper fence whether it be 4 or 14 feet high. PAGE—America's first wire fence since 1883—alone offers you a choice of five quality fence metals to fit all atmospheric conditions and an exclusive wing-channel post designed for greater utility. One of our 92 Association Members is nearby to render skilled, courteous service. Secure his name and free literature—write PAGE FENCE ASSOCIATION, Bridgeport, Conn.

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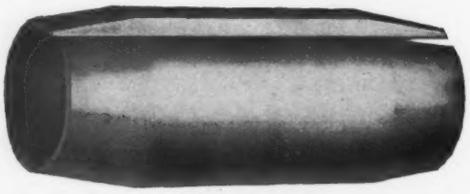
The use of National Connectors for making the underground Cable splices, saves time, increases accuracy and efficiency and reduces costs. These connectors are made exact to size of the best grade pure soft drawn copper in a size range from 12 B. & S. solid to 2,500,000 C.M. They have a guaranteed conductivity of 98% or better. You'll find that it will pay to standardize on "Nationals" for the underground jobs.



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exercising the federal power to protect interstate commerce from interference or injury arising from intrastate activities. This decision is along the same line as those which uphold the right of the Interstate Commerce Commission to protect interstate commerce from injury arising from intrastate activities of railroads or from discrimination arising from their intrastate rates.

We do not know how far the courts may go in upholding legislation affecting the operation of electric utilities. As you say in your editorial, the effects of this decision may be far reaching, but I think you will agree with me that the Supreme Court has not yet held that the utility business is interstate. In my opinion, it is not, but is still intrastate, provided the utility confines its service within the area of a single state.

I think you owe it to the industry and to your readers to write and publish another editorial headed, "Utility Business Not Interstate." Why scare us all with an editorial heading which is inaccurate?

J. V. Oxtoby
Oxtoby, Robison & Hull,
Detroit, Mich.

Develop "Blink Test" for Light-Sight Measurement

Development of a "blink test" to measure and compare degrees of human fatigue induced by various visual tests was announced recently by Dr. Matthew Luckiesh and Frank Moss of the General Electric lighting research laboratory at Nela Park, Cleveland.

What is termed a "comfort meter" is used in the test; this device makes use of the minute electrical changes that take place in the eye muscles as a person "blinks." The currents are picked up, amplified and recorded on a moving chart. Tests already made have shown that the rate of blinking decreases as lighting levels are raised to 100 ft.-candles and increases as illumination is reduced below that level.

•

Opens New Promotion Plan

Proctor Electric Co., Philadelphia, has announced that its new related promotion of the Proctor blue streak iron and the masterbilt ironing table has been extremely successful. More than 560,000 direct mail pieces announcing this related promotion have been sent out through the Philadelphia Electric Co. to its customers. The deal has also been made available through local dealers.

International Harvester ANNOUNCES A 70 H.P. DIESEL TRACTRACTOR

These Features Mean Efficiency, Low Cost, Long Life

1. Six-cylinder full Diesel engine.
2. Engine is started easily from the operator's seat.
3. Six forward and two reverse speeds.
4. Automatic clutch brake for fast gear shifting.
5. Easiest steering crawler tractor built. Power-actuated steering clutches.
6. Steering levers and pedals adjustable to suit operator.
7. Pivot shaft relieved of twisting stresses, and tracks kept in alignment, by ball-and-socket outer pivots, diagonal-arm inner pivot bearings, and roller stabilizer.
8. Track shoes keyed to track links to prevent loosening of shoes.
9. Triple-gear oil pump. Full-pressure engine lubrication at all working angles.
10. Positive track roller lubrication at all speeds. Quintuple-sealed track rollers have patented gravity lubrication at low speeds and pressure lubrication at high speeds. Oil and dirt seals on both sides of sprockets. Self-cleaning idler wheel.
11. Tocco-hardened crankshaft with replaceable main and connecting rod bearings.
12. Unit construction. Each steering brake, steering clutch, track frame assembly, and other units, adjusted or replaced without disturbing adjacent parts.
13. Famous TracTracTor accessibility. More productive hours, low maintenance cost.
14. Allied equipment engineered for the TD-18 by well-known manufacturers.

HERE is real news that operators of heavy-duty mobile power have long been looking for: International presents a new 70 h.p. (*drawbar*) Diesel TracTracTor, extending the benefits of International design and performance to a much broader field.

In this latest product you will find the sound engineering and precision manufacture that is well-known to all users of TracTracTors—*plus advanced design, many patented features and improvements.* The flexible adaptability of the TD-18, with its 6 forward and 2 reverse speeds, will be a surprise, whatever your experience up to this time.

Equipment especially designed for use with the TD-18 includes **SCRAPERS, BULLDOZERS, BULLGRADERS, ROAD GRADERS, WAGONS, SNOW PLOWS, WINCHES, LOGGING ARCHES.** Company-owned branches and International industrial power dealers will tell you all about the features of the International TD-18 TracTracTor.

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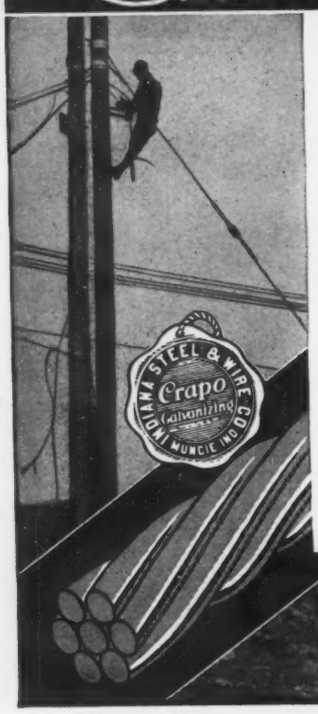

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Recent Rate Changes

PHILADELPHIA ELECTRIC CO. has filed a new reduced rate schedule for a trial period of six months, under orders of the Pennsylvania Public Utility Commission. The reduction cuts annually the bills of consumers $1,650,000.

WESTCHESTER LIGHTING CO. and the Yonkers Electric Light & Power Co., subsidiaries of Consolidated Edison Co. of New York, have announced a voluntary revision of rates designed to reduce consumers' bills by $268,000 a year. The minimum charge to each consumer will be reduced from $1 a month to 95 cents, and a rate of 2 cents a kilowatt-hour will be established for electricity consumed in excess of 150 kw.-hr. a month. At present the 2-cent rate does not become effective until 200 kw.-hr. have been used. "The change in rates," said Edward P. Prezzano, president of the two companies, "is in line with the long established policy of these companies of improving their rate structures and bettering and extending their services whenever it is feasible to do so. Under this policy, and as a result of three reductions in rates since 1935, the average rate paid by residential consumers has been lowered by approximately 35 per cent, despite increased wages and heavily increased taxes during the period." The new schedule requires the approval of the State Public Service Commission.

Public Service Co. of Colorado's offer to reduce its electric rates $1,051,600 annually has been accepted in an ordinance passed recently by City Council. The measure provides reductions aggregating 17.3 per cent for residential lighting, 17.2 per cent for commercial lighting, 15 per cent for street lighting and 4.4 per cent for industrial power.

OHIO PUBLIC SERVICE CO.'S power consumers will be saved $124,700 a year for five years under the terms of new ordinance which has been approved by Warren city council, retroactive to December 1, last. The rates, the same as those accepted in Sandusky, Ohio, recently, represent a 22 per cent reduction for domestic consumers. 25 per cent on demand charge and 11 per cent on commercial rates. Slight reduction in local rates at Port Clinton has also been effected by Ohio Public Service.

EASTERN SHORE PUBLIC SERVICE CO. has reduced its electric rates $63,000 a year. One-half the benefit goes to domestic users and half to power and commercial jointly. The commission stated that studies made by its accountants convinced the commission that there should be some reduction in rates and the subject was taken up with company officials, who indicated a willingness to negotiate with the commission.

GEORGIA POWER CO.'S commercial electric rates were reduced approximately $190,000 annually on March 1, according to an announcement by Preston S. Arkwright, president. Application of the so-called "inducement" rate to all commercial consumers, except those using less than the minimum, will bring about the saving. About 16,000 consumers already have earned the inducement rate through increased use of electric service and will not be affected by the new rate schedule. The new schedule carries out an order of the Georgia Public Service Commission in 1934 under which the "immediate" rates were authorized for a period of five years, at the end of which reductions were to be made.

Ilion, N. Y., has filed with the state

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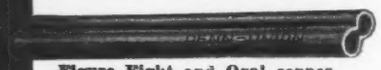

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Service Entrance Connectors, with heavy 1-piece hard drawn copper body.

Fuse Clips, Ferrule and Knife - Blade types, spring tempered bronze.

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ERIE, PA.

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Conductor Fittings

Public Service Commission a revision of electric rates which is estimated to save customers of the village plant more than $10,000 annually.

WELLSVILLE, N. Y., has filed with the state Public Service Commission a general reduction of electric rates which is estimated to save consumers of the town plant $10,800 annually.

•

Recent Legislation

The following measures affecting the electric light and power industry have been introduced in the various state legislatures:

ALABAMA—Plans are being formulated to seek a joint legislative recess committee to investigate possibilities of taxing power plants acquired by cities to the extent of recovering revenues formerly received by schools and local taxing units from these plants when they were privately operated. Senator Booth had previously introduced a bill designed to levy upon municipalities engaged in the distribution of hydro-electric energy a part of the taxes that would have been collected were the business being conducted by privately owned utilities. School leaders in particular were said to be backing the proposal largely because of the fact that since the advent of the TVA a number of private systems have been sold to or taken over by municipalities, resulting in a considerable shrinkage in tax revenues.

NORTH CAROLINA—General Assembly has received a bill to tax the sale of electric energy. Bill provides for the levy of one-quarter of a cent a kilowatt-hour on all electric energy produced or sold in the state. The bill would apply the tax as an excise or license levy in addition to all taxes now imposed on utilities. Municipalities, however, would be exempted.

INDIANA—Municipally owned utilities will be exempt from property taxes under provisions of a bill which has received final approval of the state Legislature. The measure passed the House 65 to 22 after previously having passed the Senate. Since the passage four years ago of a bill to tax municipal utilities, the question has been fought through all the courts of the state. The utilities lost in their court fights thus far, but now have been relieved by legislative action. A bill has been introduced in the Senate which would compel the state Public Service Commission to provide county and township assessors and county auditors with the commission's evaluation of utility property in the county and township.

MASSACHUSETTS—The legislative power and light committee has heard a number of bills having to do with regulation of public utility companies. Several measures relating to service reconnection charges were opposed by counsel for utilities. Sheldon E. Wardwell, representing the Massachusetts Gas & Electric Association, stated that the utilities were lenient in their treatment of customers behind in their payments and have no desire to lose a customer by any unnecessary charges. Average cost for the removal and disconnection of a meter, he said, runs around $4.

MISSOURI—David A. Hess of St. Louis has introduced a bill in the House proposing that the assessed valuation for taxation purposes of corporations in the state whose rates are subject to regulation shall be the maximum valuation allowed the corporations for rate-making purposes. Assessments for taxation of corporations are several times less than valuations computed for rate-making purposes. The bill also provides that assessed valuation of property shall be the maximum valuation from which interest and depreciation may be deducted for state income taxes. The bill applies to both foreign and domestic utilities doing business in Missouri.

NEW MEXICO—Charging that a little known 18-year-old statute has scuttled development of New Mexico's rural electrification program, members of the state Legislature have won Senate approval for repeal of the measure which prevents competition in communities of 10,000 population or less. Also under attack by a measure seeking its repeal is the 1937 law passed as a complying act to permit the state to share in the federal subsidies to rural electrification. Repeal proponents declare a "joker" has prevented projects in communities where established utilities have provided service, pointing out that competition has been outlawed by a requirement calling for the issuance of a certificate of necessity and convenience. Legislative members have proposed creation of a public service commission to replace the present corporation commission. This proposal has evoked a bitter struggle and widespread interest. This proposal for a state regulatory control over rates and service of utilities, first of its kind since New Mexico attained statehood in 1912, has been ruled unconstitutional by the state Attorney-General; the state legislative reference bureau had declared it within constitutional limits. The proposal, however, was killed when the Senate, 13 to 7, adopted an unfavorable report by the state and county affairs committee.

•

Municipal Plants

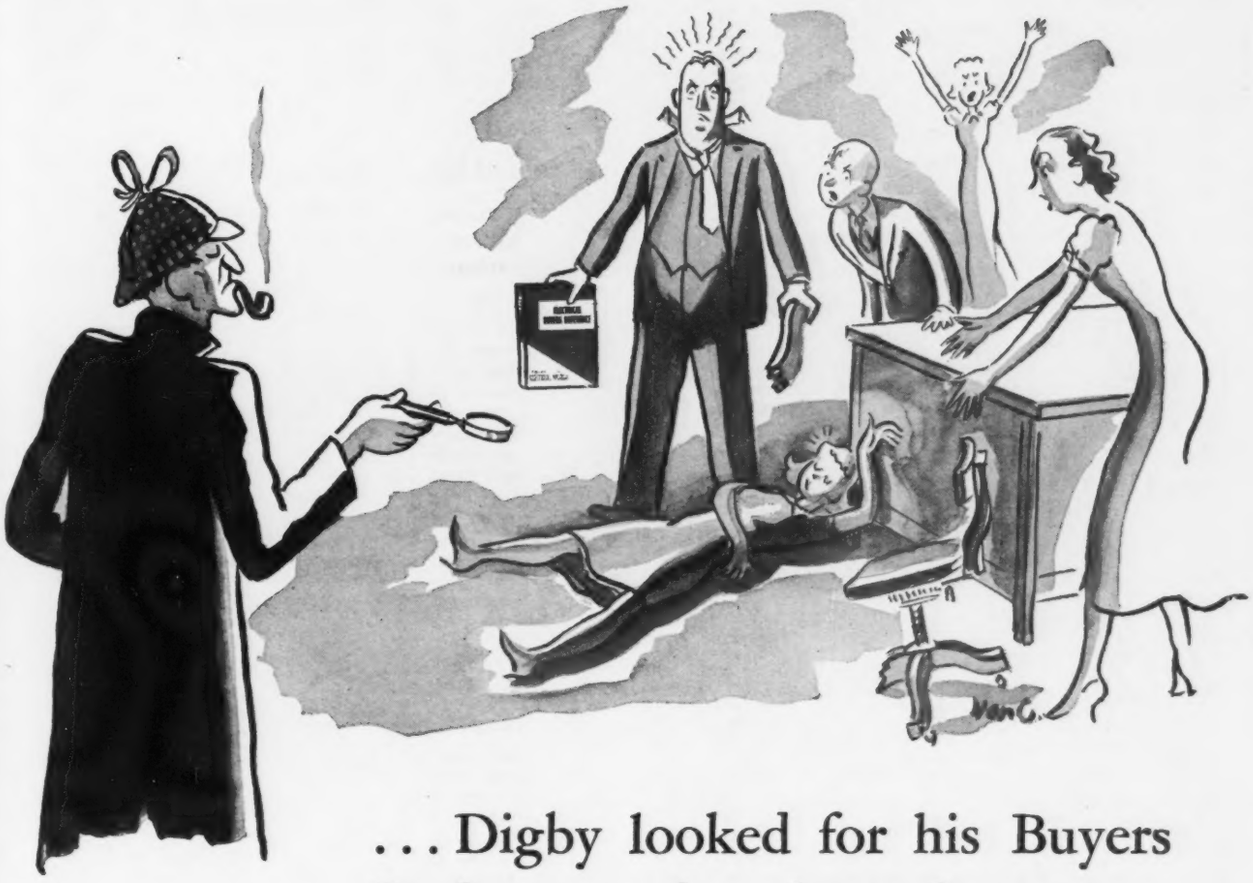
LOYALTON, CALIF. — Community has agreed to sell its plant to the Sierra Pacific Power Co. and abandon municipal operation in the interests of lower rates and better service. When the sale plan was submitted to the California Railroad Commission the members of the town council testified that the municipal service was "inadequate and unsatisfactory."

BELLEVUE, OHIO — While city officials have filed suit in Huron County Common Pleas Court to condemn the property and distribution system of the Ohio Public Service Co. as the latest action in a long standing dispute over light and power rates, a group of 150 business and professional men have protested, asking that council seek a peaceful settlement of the issue. The city offered the company $115,000 for the lines last September if the offer was accepted within 15 days. Company recently offered a third reduction in rates that would make them equal to rates recently accepted in Sandusky and Port Clinton. The new schedule offered reductions of 25 to 46 per cent to domestic users and 16 to 39 per cent for commercial consumers.

AMHERST, OHIO—Voters in a special election voted, 705 to 451, to erect a municipal light plant with the aid of a $45,000 WPA grant.

VIRGILINA, VA.—Sale of the municipal distribution in the State of North Carolina to the Virginia Public Service Company has been approved by the North Carolina utilities commission. The rates approved are reported to be considerably lower than those now charged by the municipality.

"Justifiable homicide, Watson...



...Digby looked for his Buyers Reference for three hours... *...she was sitting on it"*

Too bad. Sally was a good stenog. But she was short — and that big blue and orange Electrical Buyers Reference brought her up to desk level.

Of course she didn't know that the Buyers Reference was old Digby's right arm when it came to buying. He uses it constantly to look up manufacturers of electrical and allied products.

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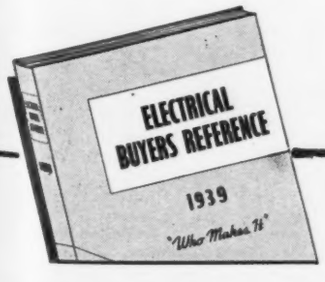

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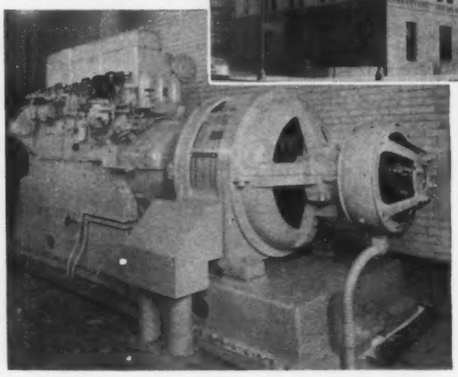

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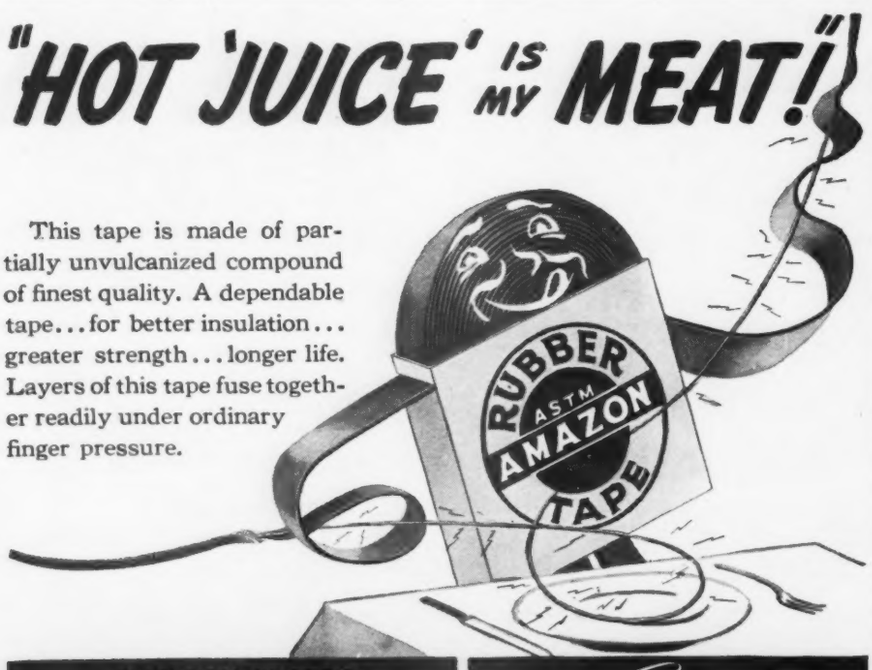

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Allots Rural Funds; Contracts Awarded

REA has announced allotments totaling $5,505,700 for 47 projects in 24 states. This brings allotments made since REA was established in 1935 to $193,479,730, of which $103,575,420 represents operations during the current fiscal year. Among the recent allotments are the following:

ALABAMA — Clarke-Washington Electric Membership Corp., Jackson, Garrard Harrell, manager, $3,200 to complete the project and to defray certain expenses connected with the initial operations of the project which cannot be covered by the construction loan.

ARKANSAS—Mississippi County Electric Co-operative, Inc., Blytheville, H. C. Knappenberger, pres., $200,000 to build 210 miles of line, 1,067 members in Mississippi County.

GEORGIA—Blue Ridge Electric Membership Corp., Hiwassee, W. O. Sparks, pres., $8,000 to complete the project and to defray certain expenses connected with the initial operations of the project.

ILLINOIS—Shelby Electric Co-operative, Shelbyville, Lester Boys, supt., $248,000 to build 217 miles of line, 680 members in Christian, Montgomery and Macon counties. Egyptian Electric Co-operative Assn., Campbell Hill, Theo Kueker, pres., $424,000 to build 402 miles of line, 1,447 members in Jackson, Randolph, St. Clair, Washington, Perry and Williamson counties. Spoon River Electric Co-operative, Inc., Canton, Oscar Linn, pres., $440,000 to build 401 miles of line, 1,210 members in Fulton, Peoria and Knox counties.

INDIANA — Hendricks County REMC, Danville, C. O. Stamper, supt., $200,000 to build 173 miles of line, 680 members in Hendricks, Montgomery, Morgan and Putnam counties. Jay County REMC, Portland, John W. Macklin, supt., $165,000 to build 159 miles of line, 586 members in Adams County.

LOUISIANA—Dixie Electric Membership Corp., Baton Rouge, Philander Smith, pres., $309,000 to build 362 miles of line, 1,311 members in East Baton Rouge, East Feliciana and Livingston Parishes.

MINNESOTA—Red River Valley Co-operative Power Assn., Halstad, E. D. Anderson, pres., $270,000 to build 271 miles of line, 566 members in Norman, Clay and Polk counties. Red Lake County Electric Co-operative Assn., Red Lake Falls, Joseph W. Ste. Marie, pres., $243,000 to build 221 miles of line, 628 members in Red Lake, Pennington and Marshall counties. Stevens-Big Stone Co-operative Power Assn., Morris, Victor Hanson, pres., $201,000 to build 195 miles of line, 458 members in Big Stone and Stevens counties.

MISSOURI — Farmers Electric Co-operative, Hamilton, Ernest Wood, pres., $505,000 to build 472 miles of line, 1,255 members in Caldwell, Ray, Daviess, DeKalb, Clinton, Livingston, Carroll, Linn and Chariton counties. Grundy Electric Co-operative, Inc., Trenton, C. H. Cullers, pres., $367,000 to build 344 miles of line, 917 members in Grundy, Harrison, Sullivan, Mercer, Linn and Livingston counties.

NEBRASKA—Stanton County Rural Public Power District, Stanton, Peter H. Claussen, pres., $155,000 to build 148 miles of line, 347 members in Stanton, Colfax and Cuming counties.

OKLAHOMA—Cotton Electric Co-operative, Walters, Louis R. Burkhart, pres.,

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(12th edition of this yearbook)

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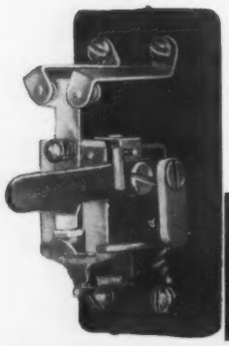

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When Buying Fuses—Compare Plus Values

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BURNDY

STRONG · CORROSION FREE · DURABLE
ONE OF THE MANY BURNDY CONNECTORS
SERVITS

$230,000 to build 234 miles of line, 708 members in Cotton, Stephens, Comanche and Jefferson counties. Verdigris Valley Electric Co-operative, Inc., Collinsville, H. R. Kenton, pres., $193,000 to build 211 miles of line, 625 members in Rogers, Washington, Osage, Nowata and Tulsa counties.

TENNESSEE—Meigs County Electric Membership Corp., Decatur, W. A. Bates, manager, $11,000 to complete the project and to defray certain expenses connected with the initial operations of the project which cannot be covered by the construction loan.

NORTH CAROLINA—Rutherford Rural Electric Mutual Assn., Forest City, D. B. Crow, superintendent, $182,000 to build 135 miles of line, 652 members in Lincoln, Gaston and Cleveland counties. Piedmont Electric Membership Corp., Hillsboro, H. G. Laws, president, $200,000 to build 200 miles of line, 748 members in Orange, Almanance, Person and Caswell counties. Halifax Electric Membership Corp., Enfield, Balfour Dunn, president, $225,000 to build 225 miles of line, 790 members in Halifax, Martin Nash and Warren counties. Anson Mutual Electric Corp., Wadesboro, U. B. Blalock, president, $300,000 to build 300 miles of line, 1,035 members in Anson, Richmond, Montgomery and Union counties. Davidson Mutual Electric Corp., Lexington, Joe L. Hege, president, $276,000 to build 276 miles of line, 1,310 members in Davidson and Randolph counties. Co-operative being formed, A. B. Ellis, Millboro, correspondent, $300,000 to build 300 miles of line, 1.040 members in Randolph, Chatham, Moore and Montgomery counties. Davie Electric Mutual Corp., Mocksville, A. E. Hendrix, president, $200,000 to build 206 miles of line 980 members in Davie, Iredell and Yadkin counties.

TEXAS—Coleman County Electric Co-op., Coleman, S. R. Hale, superintendent, $317,000 to build 384 miles of line, 999 members in Coleman, Taylor, Runnels, Concho and Tom Green counties. Karnes Electric Co-op., Karnes City, R. M. Korth, president, $188,000 to build 226 miles of line, 522 members in Karnes, McMullen, Live Oak, Atascosa, Wilson and Goliad counties.

Construction contracts:

Ontonagon County Rural Electrification Assn., Ontonagon, Mich., Cyril M. Clark, supt., and Toltz, King and Day, St. Paul, Minn., engineer, contract to Langford Electric Co., Minneapolis, Minn., second section of project, 232 miles of line, 600 members; bid $214,483.

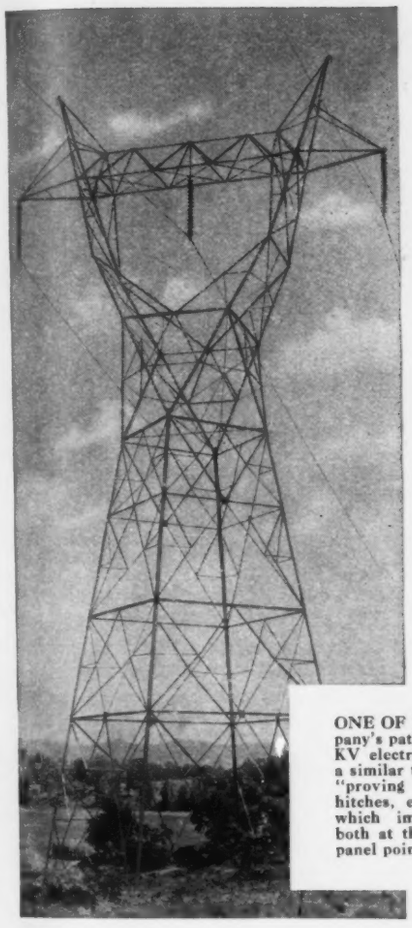
Top O'Michigan Rural Electric Co., Boyne City, Mich., Thomas A. Colter, supt., and Roy A. White, Grand Rapids, Mich., engineer, contract to Monroe Electric Co., Chicago, another section of project, 310 miles of line, 850 members; bid $234,496.

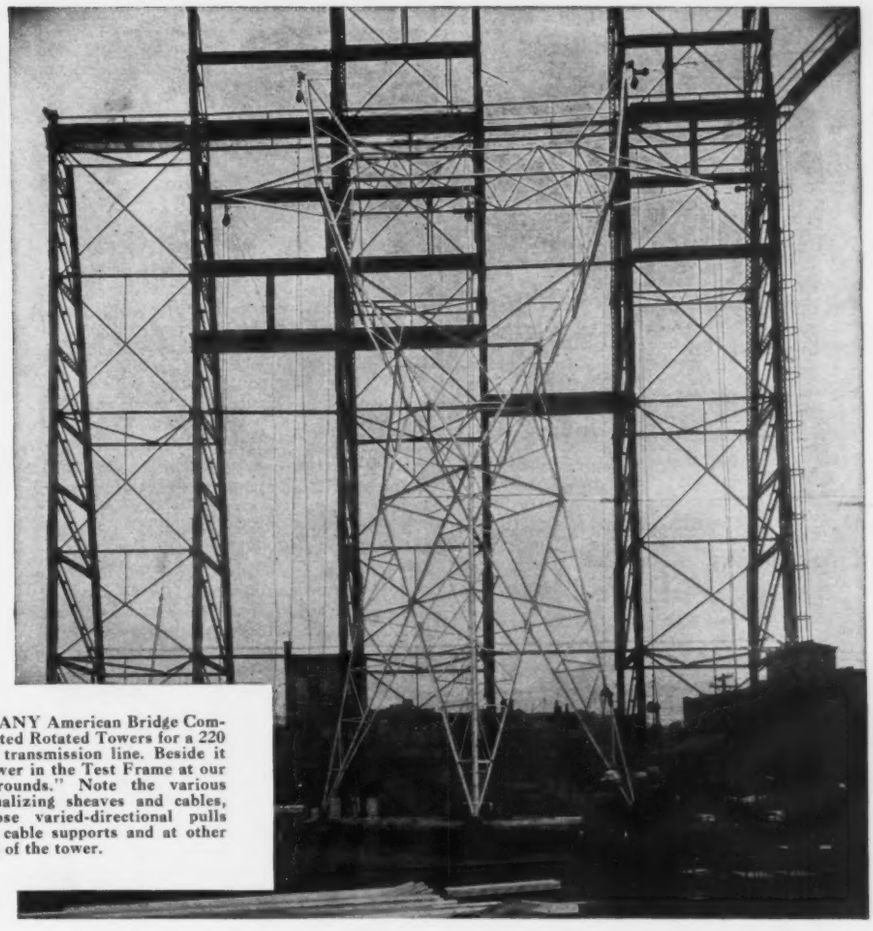
Anoka County Co-operative Light and Power Association, Anoka, Minn., George L. Morris, supt., and Bannister Engineering Co., St. Paul, and H. S. Bliss, Brainerd, Minn., engineers, contract to E. W. Wylie, Inc., St. Paul, Minn., another section of project, 184 miles of line, 390 members; bid $138,921.

Central Electric Power Assn., Carthage, Miss., E. T. Thames, supt., and A. R. Lewis, Jackson, Miss., and Francis and Haley, Birmingham, Ala., engineers, contract to Delta Construction Co., Clarksdale, Miss., second section, 275 miles of line, 700 members; bid $146,962.

Atchison-Holt Electric Co-operative, Rockport, Mo., B. S. Gibbs, supt., and H. E. Henningson, Omaha, first section of project, 209 miles of line, 389 members; bid $151,231.

AMERICAN BRIDGE "PROVING GROUNDS" put Line-Towers through the "ACID TEST"





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2. **Horizontal forces, transverse to the line, that typify wind loads and forces due to angular change in alignment.**
3. **Unsymmetrical horizontal pulls, parallel to the line, exemplifying torsional strains due to broken wires.**
4. **Test to destruction under the combined loading conditions as provided in specifications by the customer.**
5. **Tests based on either a rigid foundation condition or the usual earth footing anchorage according to designed requirements.**

Thus, not only do we design, fabricate, galvanize and erect all types of transmission towers, but also we give them the "acid test" of actual working conditions at our "proving grounds."

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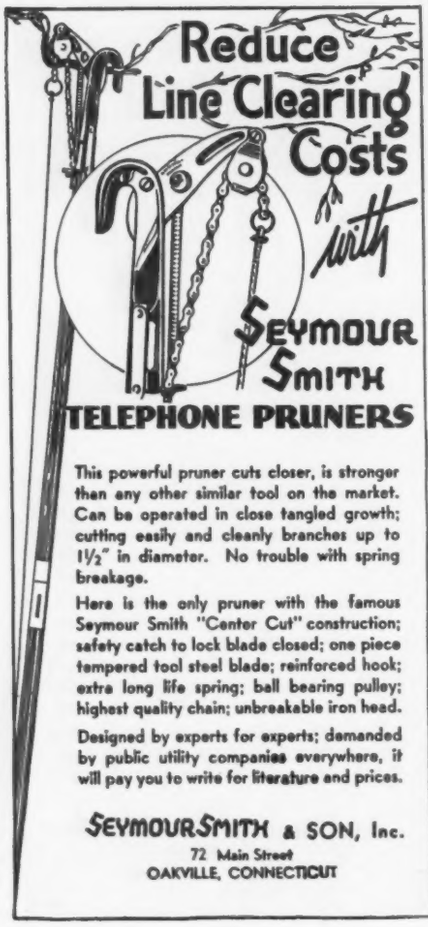

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Sales Opportunities

ATLANTIC, IOWA—Receives bids until March 22 for extensions in municipal electric power plant, including installation of additional equipment, piping, etc. Young & Stanley, Inc., 211 Iowa Avenue, Muscatine, Iowa, is consulting engineer.

ANACOSTIA, D. C.—Constructing Quartermaster, Munitions Building, Washington, D. C., receives bids until March 21 for construction and completion of portion of night lighting installation at airport, Bolling Field, Anacostia (Circular 67).

AKRON, OHIO—Goodyear Tire & Rubber Company, Akron, plans installation of motors and controls, regulators, conveyors, electric hoists, loaders and other equipment in connection with expansion and improvements in three local mills for automobile and truck tires and tubes, mechanical rubber goods, etc. Work is scheduled to begin at once and will be carried out over a period of months. Cost in excess of $2,000,000.

HIGH POINT, N. C.—City Council, E. M. Knox, city manager, receives bids until March 15 for construction of power dam, power house, spillway and auxiliary structures for new municipal hydroelectric generating station on Yadkin River, near Clemons, N. C., about 26 miles from High Point, including hydraulic works, main pipe lines and accessories. Dam will be about 85 feet high and 2500 feet long, to impound an artificial lake of approximately 14,600 acres. Station will be equipped for initial capacity of 21,000 kw. Bids will be asked at later date for transmission line to municipality, distributing lines, power substation equipment and other apparatus. Entire project is estimated to cost about $6,500,000 and financing in that sum has been arranged through Federal aid. Murray & Flood, Inc., 369 Lexington Avenue, New York, N. Y., is consulting engineer.

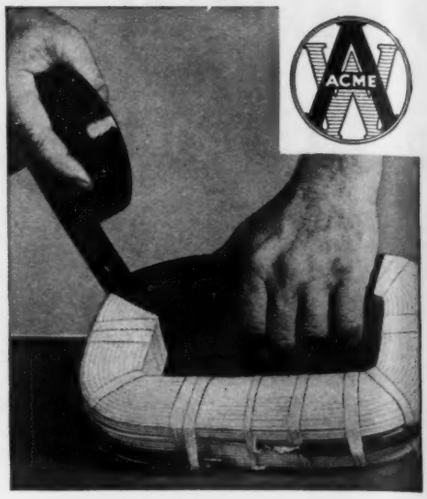
TORONTO, OHIO—The Ohio Edison Company, Youngstown, Ohio, has plans maturing for extensions and improvements in hydroelectric generating station at Toronto, including installation of additional equipment. Proposed to ask bids on general contract and required equipment during the spring.

PORTLAND, ORE.—J. D. Ross, administrator, Bonneville project, Department of Interior, Portland, receives bids until March 16 for six current limiting reactors (Circular 167).

OKLAHOMA CITY, OKLA.—Oklahoma Gas & Electric Company, Oklahoma City, plans extensions and improvements in transmission and distributing lines, including power substation facilities and other operating structures. Also will make extensions in rural electric system. Work will be carried out in conjunction with general expansion and development program in 1939, for which a total fund of about $1,850,000 has been authorized.

ALLENTOWN, PA.—Lehigh Portland Cement Company, Allentown, plans installation of motors and controls, conveyors, loaders and other equipment in connection with expansion and improvements in different mills during present year, for which a gross fund of about $3,000,000 is being arranged. Work is scheduled to begin soon.

DENVER, COLO.—Bureau of Reclamation, Denver, receives bids until March 15 for furnishing and delivering two 3500-hp., vertical-shaft, single-runner, Francis type hydraulic turbines; two oil-pressure gover-



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nors for turbine units; and for two 2,500-kva., 6,900-volt 60-cycle, vertical shaft a.c. generator units, each complete with direct-connected main exciter, pilot exciter, thrust and guide bearings, all for installation in Shasta hydroelectric power plant, Central Valley project, Calif. Equipment will be installed by Government (Specifications 831).

MARTINEZ, CALIF.—Pacific Gas & Electric Company, San Francisco, has plans for addition to steam-electric generating plant at Martinez, including equipment installation for increased capacity. Bids have been asked for foundations, to be followed by early call for tenders for superstructure and other work.

ROME, GA.—Tubize Chatillon Corporation, 2 Park Avenue, New York, N. Y., plans installation of motors and controls, conveyors, loaders and other equipment in connection with extensions and improvements in rayon mill at Rome, where new one-story addition, 147 x 175 feet, will be erected and other expansion carried out. Company has arranged financing recently in gross amount of $1,650,000, a considerable part of funds to be used for purpose noted. Robert & Company, Bona Allen Building, Atlanta, Ga., are engineers for building mentioned.

MANKATO, MINN. — Northern States Power Company of Minnesota, Minneapolis, Minn., plans new 66,000-volt transmission line from Mankato to Arlington, Minn.; also plans improvements in present 66,000-volt transmission line between Mankato and Faribault, Minn., and will expand power substation at latter place, with installation of equipment for increased capacity. A new power substation will be built at West Mankato and connection made with 66,000-volt transmission line at that point. Company also plans extensions and improvements in present transmission lines from Good Thunder to Mapleton, from Mankato to Cleveland, and from Rapidan to Mountain Lake. Work will be carried out in conjunction with 1939 expansion and development program, for which a total appropriation of approximately $4,550,000 has been arranged.

PERU, IND.—Board of Public Works is completing plans for new addition to municipal electric power plant, 48 x 104 feet, with installation of new equipment. Bids are scheduled to be asked soon. H. E. Norris, City Hall, is city engineer, in charge.

MILWAUKEE, WIS.—International Harvester Company, 180 North Michigan Avenue, Chicago, Ill., plans installation of motors and controls, switch-gear, conveyors, electric hoists, electric traveling cranes and other equipment in connection with expansion and modernization of branch plant at Milwaukee, used primarily for diesel engine production for tractors and other service. Complete project will be carried out over a period of months and is estimated to cost about $3,000,000.

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Complete Right-of-Way Deal

Payment by the district court in Portland, Ore., of $104,092 has completed acquisition by the Bonneville Authority of the Oregon Electric Railway Company's abandoned right-of-way from Portland to Eugene, Ore. This right-of-way will be used by the Bonneville Administration for its transmission line running south through the Willamette Valley.

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